THE AMERICAN GAS LIGHT JOURNAL

REDMAN&KENNY,N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXVIII. No. 22. Whole No. 1,460. | NEW YORK, MONDAY, JUNE 1, 1903. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, New York.

Telephone.—2996 John.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $5 (£1—25 francs). All payments to be made in advance. Single copies, 10 cents.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

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BRIEFLY TOLD.

EXPERIENCE DEPARTMENT, PACIFIC COAST GAS ASSOCIATION.—Mr. R. P. Valentine, of Sacramento, Cal., Editor of the Experience Department of the Pacific Coast Gas Association, in a chatty circular issued last month, the purpose of which is to secure contributions to that division of the technical proceedings of the meeting, remarks:

"The annual convention of the Pacific Coast Gas Association is but a few weeks off, and it is time the Experience Department was receiving some attention. Of course the Editor of the Department must hang out his banner and vociferously toot his horn as usual, but he hopes that at the first trumpet call every member of the gas brigade will fall in line and do all in his power toward making the Department a success. You certainly have had some experience during the past year an account of which will benefit at least some individual member of the Association, if not the body as a whole. It is of great importance to the success of the coming meeting that the report of the Experience Department should be a full and instructive one. Do not hold back. Let each and everyone do his share and thus conduce to the common good."

These well put together, sensible lines should meet with a generous and timely response, and the fraternity also should remember that it is not necessary one must be a member of the Pacific Coast Association to qualify him for sending in a contribution to Editor Valentine's Department. So, forward your facts as speedily as possible; for the Association is a live one, and Editor Valentine is worthy of your fraternal assistance.

THE NOVELTY DEPARTMENT, PACIFIC COAST GAS ASSOCIATION.—Mr. George H. Hollidge, of Merced, Cal., Editor of the Novelty Department of the Pacific Coast Gas Association, is also out with an appeal for contributions to his division of the technical programme of the coming meeting. His appeal is naturally not unlike that of Editor Valentine's, and that which was said of Editor Valentine and his aims applies with equal force to Editor Hollidge and his work in hand. Still another member of the editorial force of the Coast Association who appeals to the fraternity for aid is Mr. George S. Colquhoun, of Fresno, Cal., Editor of the Coast Association's Wrinkle Department. Perhaps it would be as well to reproduce the circular letter which he has prepared for the members in respect of his part in the Coast Association's programme. It is as follows:

"The next annual meeting of the Pacific Coast Gas Association is near at hand, so I wish to draw your attention to the Wrinkle Department, and ask that you contribute at least one of the many 'Wrinkles' which you have around your works or office, that I may have plenty of time to prepare the same for our convention in July, at San Francisco. Please send sketch or model of any new idea or device, which is not generally known to the members of our Association, and greatly oblige."

GENERAL HICKENLOOPER RESIGNS THE PRESIDENCY OF THE CINCINNATI GAS AND ELECTRIC COMPANY.—It has been pretty generally known for some months that the physical condition of General Andrew Hickenlooper, President of the Cincinnati Gas and Electric Company, was not all that it might be, and those who saw him, when last March he

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appeared for a few moments at the meeting of the Ohio Gas Light Association, were convinced that remorseless time was insisting upon payment. As the active and directing head of a great corporation, the duties attendant thereon were becoming more complex and arduous every day, and as the General's health showed no marked improvement, his family, more solicitous for the personal welfare of their kinsman and loved one, acting upon the advice of the physicians, insisted upon the General handing in his resignation as President of the Company. This he did, the formal letter announcing his determination being presented to the Directors at their meeting held the 21st ult. The General expressed the wish and hope that Mr. Norman G. Kenan, Vice-President of the Company for some time, would be named to succeed him. The General will retain his place on the Board of Directors. The Directors will formally consider the matter at the next regular meeting, which we think occurs some time this week. The General has been connected with the artificial lighting supply of Cincinnati since the sixties, and was chosen Vice-President of the Cincinnati Gas Light and Coke Company in 1873, and was elected President in 1877, continuing as such until the gas and electric lighting interests of the city were merged and placed in control of the Cincinnati Gas and Electric Company, of which corporation he was named the chief executive head.

NOTES.—

JUDGE DALLAS has appointed Mr. George Wharton Pepper, of Wilmington, Del., as Receiver of the assets, credits, etc., of the Bay State Gas Company, of Delaware.

THE Ashtabula (O.) Gas Company has increased its capital stock from $120,000 to $150,000.

AT the annual meeting of the shareholders in the Owosso (Mich.) Gas Company, no change was made in the executive management. The Company has 630 meters in use.

THE following is from the New York *Sun*, dated May 27th: "At the dinner given to Thomas N. McCarter, President of the new $25,000,000 Public Service Corporation of Northern New Jersey, by Dr. Leslie D. Ward, on Monday night at his home, in Newark, the names of the new officials of the Company were disclosed, but they were not officially announced until yesterday. The men who will constitute the executive staff are Thomas N. McCarter, President, and Vice-Presidents Randall Morgan, A. R. Kuser, Albert B. Carlton and one other, not yet selected. The Secretary of the corporation is Frederick W. Evans, once Secretary for Vice-President Garret A. Hobart, Senator Frey and the National Republican Committee, and a well-known newspaper man. The Treasurer is James P. Dusenbery, who filled the same post for the Essex and Hudson Gas Company, the Comptroller is Percy S. Young, of the Hudson County Gas Company, and the General Counsel is Frank Bergen, of Elizabeth. The Superintendent of the gas department is H. D. Whitcomb, and the Superintendent of the electric light department is Dudley Farrand, while the traction roads are in charge of Walter W. Wheatley. The executive committee, which will have general supervision over the entire working of the corporation, is made up of Thomas N. McCarter, Randall Morgan, Col. A. R. Kuser, Walton Clark, of the United Gas Improvement Company, Lewis Lillie, Uzal H. McCarter, President of the Fidelity Trust Company, Thomas C. Barr and John I. Waterbury, of New York.

THE owners of the Flint (Mich.) Gas Company have arranged for the construction of a storage holder, up to retaining 100,000 cubic feet.

WITH much regret we chronicle the death of Mrs. M. W. Faben, widow of the late Charles R. Faben, and mother of Charles R. Faben, Engineer-in-Chief of the Toledo (O.) Gas Light and Coke Company. Her demise occurred at the home of her son, in Toledo, the evening of the 18th ult. Deceased was widely known in Toledo, of which place she has been a resident since 1860, and the record of her charities there endeared her to all.

Engineering News says that a large gas engine plant is to be built for the Velardena Mining and Smelting Company, of Velardena (Durango), Mexico. This plant will comprise gas engines aggregating 2,000-horse power, operating from a central power station an ore concentrating mill, pumps and hoists at six of the Company's mines, located within a radius of 10 miles. This plant will be built by the new Loomis-Pettibone Gas Machinery Company, of New York, which also has contracts for gas engine plants driving electric generators; one of these is a 1,200-horse power plant for the Rockland Electric Company, Hillburn, N. Y., and the other for the Potosina Electric Company, of San Luis Potosi, Mexico. The Company states that it is producing power with a consumption of 2½ pounds of wood or 1 pound of good bituminous coal per brake horse power per honr.

Report of the Committee Appointed by the Ohio Gas Light Association to Determine Standard Methods of Testing Fuel Gas Appliances.

No standard method of testing now exists. Every appliance manufacturer shows you tests to prove the superior efficiency of his goods, none of which agrees with those shown you by any other manufacturer. Every gas manager buys that line of appliances he believes is the best and most economical, and yet every appliance manufacturer finds some gas manager to champion his products. It's a conundrum. What's the answer? "No uniform method of testing."

The A. S. M. E. has prescribed a standard method of testing boilers and other apparatus; the National Electric Light Association provided specifications for lamp efficiency tests; the A. I. E. E. has provided specifications for the testing of electrical apparatus; the gas engineers so far permit everyone to make his own guess.

Specifications for standard methods for testing fuel gas appliances mean: First, that we will be able to tell the relative merits of the different appliances now available. In addition to this we will be able to know how much higher efficiency may be expected. We will be able to separate and determine our losses, and when we know what occasions the losses in fuel gas appliances it will probably be an easy matter to lessen them. With improved gas appliances we are then as well equipped for an extension of our markets as we would be by a corresponding reduction in the price of gas. We are quite certain improvements can be secured which will be equivalent to a reduction of 25 cents per 1,000 in the selling price of gas as a means of acquiring more business. If you will figure what your loss of revenue will be by this reduction we think you will have a fair idea of what the benefits will be from aggressive work to improve our present fuel gas appliances and to develop other appliances

It is not an easy matter to specify standard methods of testing fuel gas appliances. The capacity and resultant characteristics of various fuel gas appliances are now left to the caprice of the designer, the line of least resistance in the factory, and the necessity of furnishing an appliance which will save the purchaser a few pennies regardless of efficiency.

This committee was appointed since this convention convened. The recommendations which follow must, therefore, be the result of hasty consideration and immature judgment. A start must be made at some time, and we think this start should be made at once. The recommendations which follow are tentative only, and are expected to be improved and refined by the results which will be secured by their temporary adoption. We believe that best results will follow by making our recommendations in argumentative manner rather than by attempting to lay down precise specifications.

Instantaneous Water Heaters.—These heaters are of two classes; those in which the products of combustion impart their heat direct to the water by contact, and those in which the heat from the products of combustion is imparted through the wall of a coil of pipe. For the present, we do not think it necessary to distinguish between these two forms of instantaneous heaters.

The heater to be tested shall be connected up with a source of water supply of a uniform pressure and a uniform temperature. Connection with the city water mains will generally suffice. The heater shall not be connected with a flue, but enough flue pipe shall be added to bring the discharge of the products of combustion into the test room at a point 6 feet above the burner of the heater. This recommendation perhaps requires some explanation; we do not feel that uniform results could be obtained by connecting with a flue, for no two flues could be depended upon to give the same draft pressure, and the draft pressure of any flue would depend on many local conditions. We, therefore, think it desirable to test by discharging the products of combustion into the test room. It is reasonable to suppose that every fuel gas appliance must be so constructed that a sufficient supply of air will be induced without a flue connection, because they must sometimes be started with a cold flue and a cold flue would produce no draft. It, therefore, follows that an increase of draft pressure must cause over-ventilation which will curtail the economy of the gas appliance, and we are inclined to think that investigation of the behavior of fuel gas appliances by the methods we are outlining will indicate the necessity of regulating this draft pressure, and this can be done by using a broken flue pipe to be set at a fixed distance above the burner of the fuel gas appliance. The arrangement we will probably recommend is shown in Figs. 1 and 2. By the use of an arrangement of this sort the operating condition of the fuel gas appliance will be under the same working conditions as it was subjected to in the test.

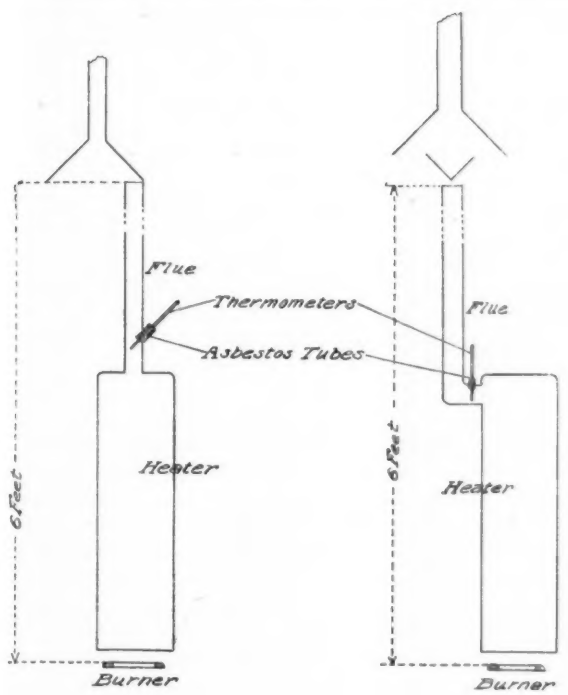


Figure 1

Figure 2

The quantity of the gas supplied to the heater shall be determined by the use of a test meter carefully calibrated for accuracy. Water shall be supplied through a suitable throttling valve at that rate of flow which will give a discharge temperature of 120° F. This temperature is fixed upon regardless of the intake temperature of the water, as the flue gases will be fully saturated at this point and, therefore, a uniform quantity of heat will be carried off by the vapor of the water suspended in a given quantity of flue gas.

As the manufacturers do not now rate their heaters in capacity of consumption, and as it would be unfair to fix on any given rate of consumption, we, therefore, recommend that efficiency be determined at different rates of consumption. The first rate of consumption for an instantaneous heater will be 20 feet of gas per hour, and the efficiency of the heater shall also be determined for each additional 20 feet until the maximum consumption of the heater shall be reached at a 2-inch pressure of water.

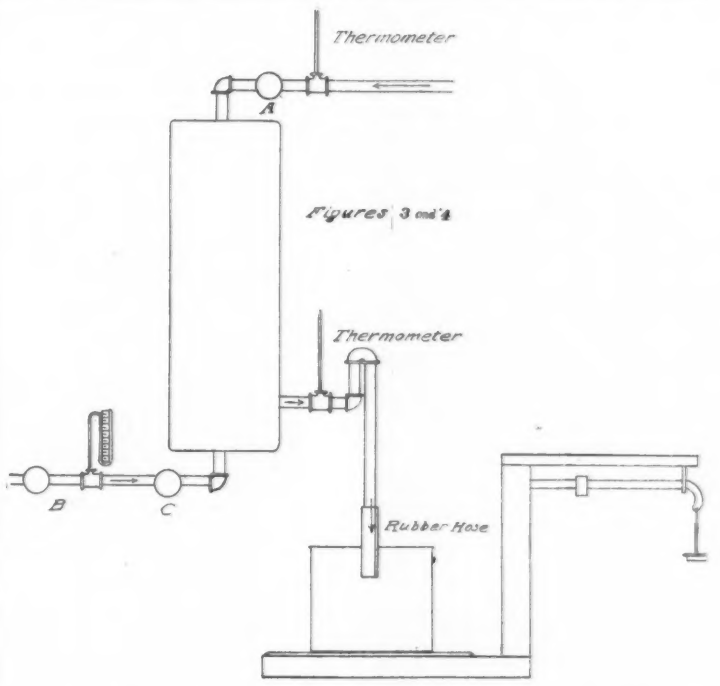
Referring to Fig. 3, *B* is the pressure controlling valve, by means of which the gas is maintained at a pressure of 2 inches, and *C* is the heater stopcock or needle valve, by means of which the rate of consumption to the heater is controlled; *B* should preferably be a pressure regulator rather than a valve, as some manipulation will be required to control the pressure when the rate of flow is changed.

The water from the heater shall discharge into a vessel supported upon a platform scales, as shown in Fig. 3.

The efficiency at each rate of consumption is to be stated in per cent., and shall be determined by dividing the total heat added to the water by the total heat the gas supplied is capable of developing. The amount of heat added to the water shall be determined by taking the temperature by means of thermometers, as illustrated in Fig. 3, and the weight of the water multiplied by the difference in temperature will give the number of B.T.U.'s supplied to the water. To determine the quantity of heat the gas was capable of developing must be done either by a calorimeter measurement or by a calculation from the analysis of the gas, multiplying each elementary gas by the heat of combustion of that gas, as given in various text books. If the heat of the gas cannot be determined, accurate comparative results can be secured by testing all competitive appliances simultaneously and allowing an arbitrary value for the gas. It is customary to estimate the heating value of coal gas at 650 B.T.U.'s, at a pressure of 30 inches of mercury at a temperature of 60° F.

Determination of Losses.—The losses in an instantaneous water heater are due to: First, radiation; and, second, sensible heat carried off in the products of combustion. This latter loss can properly be divided into A, the necessary sensible heat carried off in the products of combustion, if only sufficient air were passing through the burner to obtain complete combustion; and B, the loss due to over-ventilation or the unnecessary amount of air passing through the heater.

We see no satisfactory manner of determining the radiation loss directly, and must, therefore, leave this loss to be determined by deduction.



The second loss is determined by taking the temperature of the flue gases by inserting a thermometer at the base of the flue pipe and observing the temperature of the discharged gases. By analyzing the discharged gases by means of an Orsat apparatus, the quantity of each elementary gas can be determined. This quantity, multiplied by the specific heat of this gas and multiplied by the observed temperature, will give the sensible heat carried off by that particular gas, and the sum of these quantities will give the total amount of heat carried off by the entire products of combustion. The second loss is then divided into A and B by calculating the amount of heat which would have been carried out of the flue at this observed temperature had only sufficient air been supplied to theoretically obtain complete combustion. The flue gases are most readily analyzed by the use of the Orsat apparatus, as shown in Fig. 5.

The apparatus consists of the measuring burette *A*, containing 100 cubic centimeters, and of the absorption bulbs *B*, *C* and *D*. The burette is inclosed in a glass tube which serves as a water jacket. A levelling bottle *L* is connected to the lower end of the burette with rubber tubing. This bottle contains water to which a little salt has been added. By raising and lowering it, the water forces or draws the gas into the various parts of the apparatus. Connected to the upper end of the burette is a long capillary tube *E*, which has three branch tubes, *O*, *P* and *R*, each supplied with a glass stopcock. The absorption bulbs are connected to these branch tubes by rubber tubing, as shown in the figure, and usually contain small glass tubes, which serve to bring the various reagents into intimate contact with the gas mixture. The form of apparatus shown has a fourth bulb *H*, and a palladium asbestos tube *F*, for the determination of the combustible gases, but for gas appliance work only the first three bulbs *B*, *C* and *D* are necessary.

The principal ingredients of spent or flue gases are carbon dioxide (CO_2), carbon monoxide (CO), oxygen (O), and nitrogen (N), and these are all that will be determined—the first three by direct reading of the burette and the last by difference.

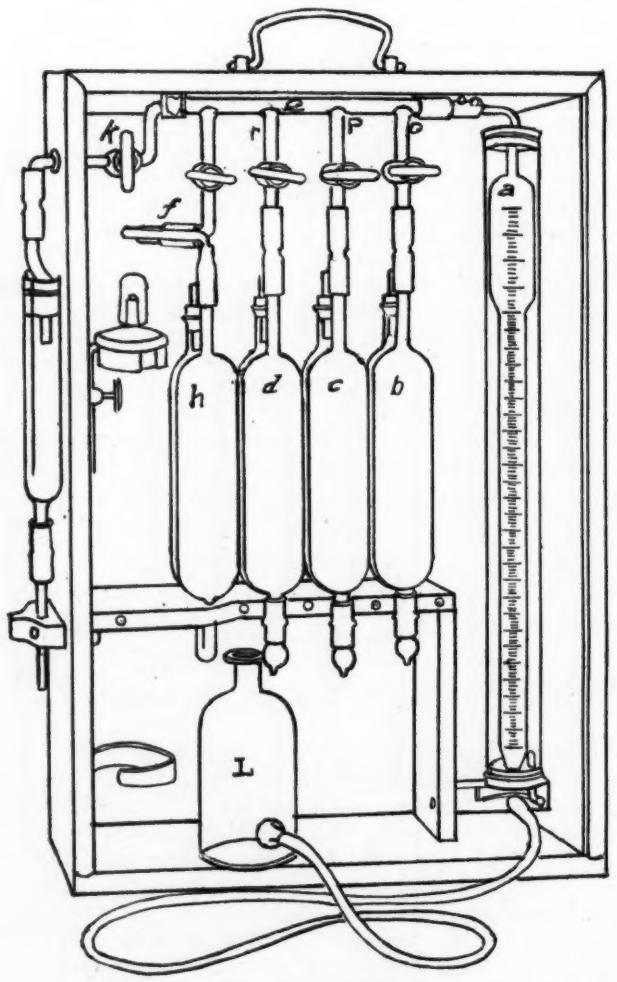
The reagents used for the absorptions are as follows:

For CO_2: A 16 per cent. solution of caustic potash (KOH), made by dissolving 16 grams in 84 ccm. of distilled water.

For O: An alkaline solution of pyrogallic acid ($C_6H_3(OH)_3$). Dissolve 20 gm. of pyrogallic acid in 100 ccm. of water. When about to use, mix some of this solution with its own volume of the potash solution.

For CO: A strongly acid solution of cuprous chloride. Dissolve 16 gm. of the red oxide of copper (Cu_2O) in 100 ccm. of strong hydrochloric acid, specific gravity 1.19. Keep this solution in a glass stoppered bottle with scraps of metallic copper.

The reagents are applied in the order given: Bulb *B* contains the KOH, *C* the pyrogallic acid, and *D* the cuprous chloride. The analysis is conducted as follows:



ORSAT APPARATUS.

Figure 5.

The reagents in the bulbs should be drawn up to marks on the capillary tubes above the bulbs. Then open the stockcock *K*, raise the levelling bottle *L*, until the burette and capillary tube are filled with water, and close *K*. Attach the bag containing the sample to the end of the capillary tube, lower the levelling bottle and open *K*. When the water in the burette is ¼-inch below the zero mark, close *K* and place the bottle on the table or on the frame, as shown in the drawing.

Allow it to stand for a few minutes so that the gas may be at the same temperature as the water in the water jacket, in the meantime detach ing the sample bag. It is most convenient to work with exactly 100 ccm. of gas and at atmospheric pressure. Hold the levelling bottle by the side of the burette so that the water in the burette is at the zero mark, then pinch the rubber tube between the fingers, set the bottle down and open *K* for an instant. Repeat this until the burette reads zero when the water level in the bottle is at the same level as the zero mark. Then open the stopcock to the bulb *B*, raise the levelling bottle, and force all the gas into *B*, being careful to allow no water to enter with the gas. Then lower the bottle and draw the gas back into the burette until the KOH in *B* has risen to the mark on the capillary tube above the bulb, and close the stopcock. Repeat this twice, and take a reading with the bottle so that the water level in it is the same as in the burette. Force the gas into *B* once more and let it stand for a few minutes. Upon bringing it back, if the reading is the same as before—say 20—it shows that there was 20 per cent. of CO_2 in the gas.

If the reading differed from the first one, repeat the absorption until the reading becomes constant. Then the remainder of the gas is forced into *C* and *D* successively, in exactly the same manner, but as O and CO are more difficult of absorption than CO_2, more time is required, and it is well to let the gas remain in contact with the absorbent for from 5 to 10 minutes.

If we obtained readings of 20, 31 and 32 successively, they would indicate that the gas contained 20 per cent. CO_2, 31 — 20 = 11 per cent. O, 32 — 31 = 1 per cent. CO, and 100 — 32 = 68 per cent. N. These results are in per cent. by volume, and if it is desired to give final results in per cent. by weight, this can be most readily done by multiplying the percentage by volume of each constituent gas by the density of that gas, then dividing this product by the sum of the products of the multiplication of all constituents. Each quotient will then give the percentage by weight for that particular gas.

Coal gas contains a large percentage of H and generally some O. Upon ignition they unite, 1 part by weight of H, combining with 8 parts by weight of O to form 9 parts of water. As there is never enough O in the gas itself to satisfy the H, the remainder must be furnished by the air. Multiply the per cent. by weight of H in the gas by 8, and the result is the amount of O necessary for the combustion. From this subtract the amount of O present in the gas, and the remainder is the O to be obtained from the air. As atmospheric air contains very nearly 23 per cent. by weight of O and 77 per cent. by weight of N, if we multiply the amount of O to be obtained from the air by 3.34, the result will be the "excess nitrogen," so called because its accompanying O does not appear in the flue gas analysis, being in the form of water. By means of the relationship between O and N in the air—that is, the proportion 1 : 3.34—the accuracy of a flue gas analysis can be checked. After reducing the analysis to per cent. by weight, subtract the "excess N" from the actual N present; this is the remaining N. Sum up all the O in the CO_2, O and CO, and multiply it by 3.34. If the product is not very nearly equal to the remaining N, you may conclude your analysis is wrong.

Taking the density of air as 1, the densities of the other gases will be as follows:

CO_2	1.519
CO	.967
O	1.105
N	.970

The sample of flue gas is readily taken by means of a small pipe or gas jet screwed into the flue, some rubber tubing, glass tubing, and a rubber aspirator. This aspirator is an oval bulb about 4 inches long and 2 inches in diameter, and contains two valves—an inlet and an outlet. Upon pressing it, the outlet opens and contents forced out—releasing the pressure opens the inlet and draws in more gas while the back pressure closes the outlet. The inlet side is connected by rubber tubing to the pipe, and the outlet side also has a piece of rubber tubing attached, in which is inserted a small piece of glass tubing to facilitate making connections with the sample bag. For collecting the sample, a rubber bag about 8 inches in diameter when inflated, is convenient. It has a piece of tubing attached. All the air is carefully expelled from the bag by rolling it up, and then the glass tube of the aspirator is inserted in the bag, and the latter filled with gas by means of the aspirator. When full, the glass tube is pulled out and a pinch-cock placed around the tube of the bag. To insure a sample free from air, it is best to fill and empty the bag several times before taking a sample for analysis.

Measurement of Radiation Loss.—By summing the total heat added to the water and the total heat contained in the discharged gases, and deducting this quantity of heat from the total heat the gas was capable of developing, the difference should represent the loss of heat due to radiation.

[To be Continued.]

A Few Items of General Interest.

[Contributed by MR. FREDERIC EGNER.]

In looking over the contemporaneous literature relating to the gas industry, a monthly under the title of *Die Gasmotorentechnik* deserves mention. The writer has before him No. 1, Volume III., of this very thorough little monthly magazine. It is devoted entirely to the "Gebiete der Verbrennungsmoteren," which, freely translated, means the industry concerned with the manufacture and application of motors in which gas or oil vapors furnish the motive power, and which we sometimes also call combustion engines. While represented in every country in Europe this very useful publication apparently cannot as yet be had in the United States. Single numbers cost in this country 75 cents; the annual rate of subscription is something like $5.50. Let us look over the present number and see if it interests us sufficiently to make it worth while. Personally the writer may say that he has had several times the value of an annual subscription out of each number perused to date; but that is only from his point of view, which may

make a difference in a good many cases. The first article in the number under consideration is a "Call to the Combustion Engine Industry for Participation in the World's Fair at St. Louis." And this "Call" is in the nature of an editorial, giving very clearly the cost to manufacturers for such participation and the advantages to be obtained through the same. The Editor-in-Chief is Herr Ernst Neuberg, C.E., and if the German manufacturers of gas and vapor engines, autos, and in fact gas motors of every description, are not well represented upon that occasion it will not be because of want of intelligent effort on part of the editor of the publication named. Permit the writer in imitation just once to give the "German" of some of the terms found in the first article: "Die Verbrennungskraftmaschinen-Industrie," which means the combustion engine industry, will answer for a sample, but "there are others." It is no doubt understood that while the German orthography is a little perplexing to outsiders, the statements of scientific facts are usually very lucid, though bordering at times on the cumbrous, and while we may indulge in a little joke now and then at our able transatlantic confrere's word-building no disrespect is intended. The next article is one concerning the proportions and resistance required in cylinder heads of the larger class of gas engines, by Dr. Rudolph Wager. Then we strike a familiar name, that of our old friend, Herr Wm. von Oechelhaeuser, who has evolved a gas engine system of his own. And its application to blast furnaces, employing only producer gas, is most interestingly described by word and picturing, two fine plate illustrations forming part of the article.

Then we find four pages of statistics, showing the number of gas engines attached to, or being applied by, German gas works; and these figures will give the reader an idea how much further Germany has progressed in this cheapest of all motive powers than we have here in America. Incidentally we also learn the rate of progress made by the gas engine in public favor. Two hundred and thirty-one German cities are named, and the numbers of gas engines used in each year, beginning with 1881, up to and including 1901, are given. Adding up only the first and last columns, the writer finds that of these 231 cities, 66 only had gas engines with a total of 2,442-horse power, in 1881, while in 1901 all of those named (231) aggregated a total of 101,135-horse powers. As the average price at which gas is sold in Germany is considerably higher than in this country, when we take into consideration the difference in the purchasing power of the dollar in America and of the mark in Germany, and as the Germans as a rule are particularly "strong" in economical expenditures, or in other words, saving money wherever possible, the fact that gas engines are so much favored there carries with it a lesson of such significance that it does seem that our people should take notice of and learn it. It has, indeed, often been a cause of speculation and wonder to the writer that, despite our extreme "dollar worship" the fact that gas engines are the most economical source of artificial power, even water power under some conditions not excepted, has not yet impressed itself more deeply upon the senses of our manufacturers. But as there are many gas men in whose interest it would be to boom gas engines, and who seem also not to have awakened to these facts, the lack of inquiry on the part of possible users is not to be wondered at.

From the same article we learn that the German Association of Gas and Water Engineers have undertaken to obtain and furnish to their members the following statistics: "The number of horse powers (gas motors) supplied by gas works; the number of motors (gas) supplied by gas works; the average horse power of the gas motors thus supplied, and the quantity of gas consumed per annum by these engines."

Fancy one of our Gas Associations undertaking such a work! But that they could if they would cannot be doubted. Next we find in this number an article on the use of the "Crosby Indicator," illustrated and with explanations by the Editor-in-Chief of the magazine. Then there is a "mere communication," for which kind of matter the responsibility on part of the editor is pointedly disavowed. Yet it is a very interesting article, with four fine illustrations, showing, among others, a proposed Westinghouse gas engine installation of 50,000-horse powers. Such articles make one feel pity for the gas man sometimes met with, who wants to know if the gas engine is now sufficiently perfected to warrant one in undertaking its employment without drawbacks or loss. Following this article will be found a fine illustration, copied from the 48th annual report of the German Continental Gas Association, showing one of their central station gas engines; also five illustrations of a 1,500-horse power Westinghouse gas engine. The Company named owns 18 gas plants; but having on a previous date sent translations of a number of the most salient points of the report mentioned to the JOURNAL, I will not go further into that matter here. The report is interesting reading, and shows up German conditions in the gas industry in an interesting and instructive manner. One of the articles in this number describes a 4-cylinder, 2,000-horse power gas engine, using only blast furnace gases.

A little further along is an article by Mr. F. B. Wheeler, of Binghamton, N. Y., describing in a 2-page article the evolution of the gas engine, with special reference to later years; and we find in it that "there's something doing" in America too with engines intended to use blast furnace as well as other comparatively poor (in heat units) gases. Especially do we find the Backus Water Company Heater, of Newark, N. J., and the De la Vergne Refrigerating Machine Company, of 138th street, New York, mentioned as builders of very effective gas engines. It seems a pity to the writer that these Companies do not think it worth while to figure in at least the advertisement columns of the JOURNAL once in a while; but the reasons at one time given the writer as the cause why they did not was they "Knew they had a good thing; so let the gas companies come to us. It's their interest to sell gas, not ours," which seems a very silly process of reasoning it out.

A couple of pages are devoted to patents. Here we find abstracts from the patent issues not only of Germany, but of France, England and America. Some of the illustrations are quite good. Among others we find a rotary gas engine, by James Wallace Tygard and Henry Alexander Wise, of New York, and while a revolving steam engine never amounted to much, this revolving gas engine, to say the least, looks pretty good as to design and seems practical. The old side-lever principle of the steam engine has also been applied to gas engines with apparent good effect, and the number of new inventions in the gas engine line as shown in only this one number of the issue of a paper devoted solely to such engines, indicates that many bright minds are busy with improvements in an industry which deserves all the encouragement which those interested in the art of making and selling gas can give it. Not only the columns of reading matter but the advertisement pages as well are interesting. Here will be found a half page advertisement of the *Journal für Gasbeleuchtung*, that *Journal* par excellence of the gas industry not disdaining to advertise and show its light in its humbler contemporary's columns; and the Italian "Il Gaz," of Venice, does the same.

A notable advertisement is that of a "First-class machine manufactory," who "want a gentleman competent to act as chief engineer and chief of construction for their Diesel Motor Division," which indicates that that excellent machine is not yet shelved as many thought, but more likely may be heard from to some purpose before a great while. On the whole those interested in gas engines, and who are able to read to understand the German language, will find "Die Gasmotorentechnik" worth having. In size the magazine is about twice that of that bright little American periodical, "The Gas Engine," published at Cincinnati, devoted to the same industry, but, of course, in the English language, which can also be recommended to those more specially interested in the gas engine, its progress and improvement.

A New Material for Pipe Joints.

Engineering says that for many years the joint spaces in bell and spigot joints of cast iron water, gas and plumbers' pipes have been most commonly filled with molten pig lead, which is calked after it has cooled. For several years a Philadelphia gentleman has been experimenting with mixtures of various common materials, seeking to produce a compound to be used not only for pipe joints but for many other common purposes. A few years ago his efforts were successful and the new material was patented. It has been given the name "leadite" because it replaces lead in many ordinary uses. The chief ingredients, as described in the letters patent, are sulphur, brick dust and sand, but various other materials are incorporated with these in varying proportions, according to the use to be made of the mixture. Some of the characteristics claimed for leadite are: "It weighs 118 pounds per cubic foot, or one-sixth as much as lead; it melts at 310° F., while lead melts at 618°; it is a good non-conductor of electricity and is not affected by acid; it can be remelted repeatedly without waste; it solidifies upon cooling and firmly adheres to metals, glass, wood and many other substances; it is impervious to water; it never corrodes, and it is not malleable."

As ordinarily prepared for making pipe joints, leadite is of a leaden gray color, but it can be colored during manufacture in a variety of ways if desired for ornamental purposes. When used as a jointing material it requires no calking and it is tight under high pressures. Owing to its lower specific gravity, a given weight of leadite will make six times as many pipe joints as the same number of pounds of lead,

and consequently a great economy is claimed in its use for this purpose. Its efficiency in water pipe joints has been tested by several years of actual use. In 1894 about half a dozen joints in 48-inch pipe were made with this material in Philadelphia, and in 1895 some 1,800 feet of 4-inch pipe, likewise connected with the Philadelphia water works, were also jointed with it. In addition to these, hundreds of joints have been made at various times, and it is stated by one of the prominent men of the department that these joints have been very satisfactory. The pressure in the pipes in some cases has been as great as 140 pounds per square inch. For making the joints an ordinary pipe jointer is used and the material is melted and poured in much the same way as lead is; but as soon as the leadite is cool the joint is completed, as no calking is required. If, in further practical experience, this material justifies the claims made for it, considerable changes in methods of pipe laying may result and also in the amount of metal required in the pipe bells. The material is furnished by the Leadite Company, of America, 2135 N. 29th street, Philadelphia, for numerous other purposes than pipe joints.

The Unity of the Four Great Branches of the Engineering Profession.[1]

Within recent years much has been said of the importance of specialization in engineering. There is perhaps a tendency to forget that to attain greatest success as a specialist the engineer must possess a fair knowledge of every branch of engineering.

Historically, we know that the first railway was invented by practical miners, and was developed by self-educated mining engineers. On the other hand two of the most valuable machines used by the mining engineer were invented for, and developed in, civil engineering work. We refer to the rock drill and to the stone crusher. The percussion power drill was developed into a practical everyday machine in the work of driving the Hoosac tunnel. The first successful stone crusher was used in crushing rock for macadam roads, and its inventor probably never dreamed of its present enormous use in breaking ore for milling purposes. To the engineer who is ever on the alert to economize in production, the foregoing two examples serve to illustrate the importance of watching the progress of engineering science in other branches than his own specialty.

The derivation of the word engineer and its French equivalent, *ingenieur*, implies the exercise of ingenuity. An engineer of the highest type is always an inventor. He seeks to learn all that other engineers have done in the way of economic production, and then combines the knowledge so acquired with that derived from his own experience or reasoning.

The engineer applies science to economic production; and his genius is measurable therefore in dollars and cents. To quote again Mr. McHenry's definition, to which we have frequently referred: "Engineering is the art of making a dollar earn the most interest." Herein the engineer differs from all other professional men, but in this essential characteristic engineers of all classes are alike.

No sharp line can be drawn between civil, mining, mechanical and electrical engineering works. Thus a consulting mining engineer must not only be familiar with the chemical, mineralogical and metallurgical parts of his professional stock in trade—the parts that really differentiate mining from civil engineering—but he should be familiar also with numerous other fields. For example, he should have a knowledge of electrical engineering; and not a mere smattering, but a clear understanding of the principles of electrical engineering work. Water power is frequently available in the mountain districts where ores are usually mined, and the mining engineer should know enough of the generation, transmission and utilization of electricity to be able to advise his clients as to the economic applicability of electric power in any given case. It may be said that the mining engineer should take the advice of an electrical engineer; but if he does this he will fail to fulfil the reasonable expectation of his client. It is the mining engineer that should in all ordinary cases take the responsibility of deciding whether or not to use electric power. After he has decided to use it is the time to call in the electrical engineer to plan the details.

On the other hand, the consulting electrical engineer should have a knowledge of mining methods and conditions, for economic design is impossible without such knowledge. Thus the electrical engineer may be called upon to design and install an electric mine plant which is to be used for hoisting, ventilating and drilling. If he is not familiar with mining conditions, he is practically sure to make costly blunders. Take the electric drill, for example. He may have seen one of a certain type used in a quarry, or in an experimental shop, with most excellent results. He therefore recommends it. Later he learns that the highly corrosive acid waters, dripping from the roof of the mine, quickly eat away and destroy certain parts of the drill mechanism: or he finds that the rough handling of the drill by the miners, as they hurriedly remove it before blasting, rapidly knocks the drill into a condition of "innocuous desuetude."

It may be replied to this line of reasoning that the mining engineer should have forewarned his electrical professional brother by stating the conditions. However desirable it may be that the two engineers work thus together, in practice they seldom do; and the mining engineer may never for a moment suspect that the electrical engineer does not know that iron pyrites by oxidation produces sulphuric acid which is highly corrosive; or he may fail to consider that a man must actually have seen or read of conditions in order to have them in mind when busy with a design.

Whether it be in spanning a continent with rails of steel, or in mining the ores from which that steel was made—whether it be in designing locomotives to haul cars over those rails, or in making a dynamo to light these cars, men of the four great divisions of engineering science are working together and with one object—economic production.

In view of all these facts, is it not the veriest absurdity for one division of engineering work to claim superiority to another? All alike are founded on the great fundamental laws of physics and chemistry. Each at the present day has equal claim to be considered a scientific profession and not an empirical art. No great work of the first rank can be carried out without the aid of all four divisions of the profession and their hearty co-operation with each other.

And if this co-operation can exist in the work of the profession for the public, why should it not also exist in the work which the profession does for its own improvement and advancement? Specialization in this work has been found beneficial; and new organizations are all the time coming forward devoted to particular specialties in professional work. As illustrations of such specialization we may cite the Society for the Promotion of Engineering Education, the Engine Builders' Association, the Society for Testing Materials, the Railway Engineering Association, the Municipal Electricians' Society. Such specialization is advantageous to the profession, but it is perfectly compatible with harmonious co-operation for the attainment of common ends.

We have long maintained that the profession as a whole is heartily in favor of co-operation. The response of the great engineering societies to Mr. Carnegie's munificent offer seems to us to fully prove this. Such letters as those which we have printed from members of the American Society of Civil Engineers in this and our preceding issues are conclusive evidence that the leaders of the engineering profession are glad to emphasize the profession's essential unity and to work for harmonious co-operation among the organizations representing its various branches.

1. *Engineering News.*

Statistics of the Massachusetts Electrical Supply Systems in 1902.

By Mr. Alton D. Adams, in *Elec. World.*

Dynamos at electric lighting stations in Massachusetts had a combined capacity of 84,375 kw. on June 30, 1902. These figures represent an increase of 21 per cent. over the like capacity of the previous year. In spite of this increase, the number of dynamos employed stood at 868, representing a loss of 60 machines in the previous 12 months. These movements were due to the general tendency to replace small belted dynamos with much larger direct connected units, which carried the average capacity of all generators from 74 to 97 kw. each.

Changes in the capacities of the several classes of dynamos were very unequal during the year. Arc machines sustained a loss of 18 per cent. and stood at 10,110 kw. Generators used for power purposes only, represented 15,926 kw., a gain of 12 per cent. Dynamos suitable for incandescent lighting gained 35 per cent. in capacity and reached 58,339 kw. From these figures it appears that arc dynamos had 12, power generators 19, and dynamos suitable for incandescent lighting 69 per cent. of the total capacity at lighting stations. Compared with the previous year the arc dynamos had lost 5 per cent. and the power generators 1 per cent., while incandescent dynamos gained 7 per cent. of the total station capacity. The capacity lost by arc dynamos was greater than the gain in power generators, so that the increase of capacity in generators suitable for incandescent lighting was greater than the total increase of the systems. At the rate of shrinkage here

indicated for arc dynamos, a few years will see their entire disappearance from electric systems. The obvious cause of this movement is the substitution of inclosed arcs, at constant pressure for interior lighting, and at constant, alternating current for street service, in the place of series direct current lamps. Generators of the direct current type for the supply of power only are employed in some instances to operate railway rather than stationary motors, so that it is impossible to state just how much of the increase in their capacity was applied to either purpose.

Dynamos suitable for incandescent lighting, of both the direct and alternating current types, are now largely applied to the operation of stationary motors, and this fact accounts in part for the marked rise of capacity in this class of machines.

Dynamos at Electric Lighting Stations in 1902.

	Number.	Total Kw.	Average Kw.
Total	868	84,375	97
Increase	60*	14,941	23
	Arc.	Incandescent.	Power.
Kilowatts	10,110	58,339	15,926
Increase	2,124*	15,242	1,823
Percentage of total capacity.	12	69	19
Loss of percentage	5	7†	1

Engines, Boilers and Water Wheels.

	Number.	Total Horse Power.	Average Horse Power.
Engines	327	102,390	313
Increase	17*	13,042	53
Boilers	345	60,593	176
Increase	14*	270	8
Water wheels	43	9,623	224
Increase	1	191	0

* Decrease. † Gain.

Steam engines, like dynamos, show a rise of total capacity coupled with a decline in numbers during the year. Thus the total number of engines at electric lighting stations was 327, representing a loss of 17, and their combined capacity was 102,390-horse power, a gain of 14 per cent. Along with this increase of total capacity came a rise of the average horse power to 313, or 20 per cent. above that of the previous year. Boilers fell back to 345, a loss of 14 in numbers, but stood at 60,593-horse power, showing a small gain of 270-horse power in total capacity. This movement raised the average horse power by 8, or to 176 per boiler. The fact that engine rating exceeded that of boilers by 68 per cent. is accounted for in large part by the practice of allowing an evaporation of 30 pounds of water per horse power hour for boilers, while economical engines operate at a much lower rate of consumption.

A single water wheel was added in the electric light stations of the State during the year, and the total wheel capacity was thus raised to 9,623-horse power. Of the combined rating of engines and water wheels amounting to 112,013-horse power, the wheels represented only 8.6 per cent. The total rating of dynamos reduced to horse power amounts to 112,500, or 9.8 per cent. more than the rated power of engines, but almost exactly equal to that of engines and water wheels combined.

On June 30, 1902, 8,042 stationary motors were connected to electrical supply circuits within the State, and the combined rating of these motors amounted to 34,570-horse power. The average horse power of these motors was 4.2, representing a rise of 0.3-horse power each during the year. Motors on circuits operated by power generators fell to 22 per cent. of the total number, a loss of 12 per cent. in 12 months, while motors on circuits operated by dynamos used also for incandescent lighting gained 13 per cent. in relation to the number of all motors and closed the year at 78 per cent. of the total. A single arc motor remains in the field. Boston contained 4,435, or more than one-half of all the motors supplied by electric light stations in the State, and the average capacity of these motors was 4.4-horse power each. The total capacity of motors at Boston was 44 per cent. of that for the entire State. The loss in the total number of motors at Boston, as well as the loss of 989 motors from the circuits of power generators throughout the State, was due to changes at Boston by which 1,086 motors were dropped from the circuits of power generators in that city. All of the motors at Boston were thus brought into circuits fed by generators that also supply incandescent lamps. As the number of motors operated by power generators decreased 1,086 at Boston, but only 989 for the entire State, it follows that there was a gain of 97 motors of this class outside of that city.

Stationary Motors Connected to Electrical Supply Systems.

Circuit.	Number.	Gain or Loss.	Horse Power.
Arc	1	4*	....
Power	1,747	989*	....
Incandescent	6,294	1,064†	....
Total	8,042	75†	34,570
Motors at Boston	4,435	358*	19,670

* Loss. † Gain.

Total Arc Lamps.

	Single Open.	Double Open.	Inclosed.
Number in State	1,690	6,066	19,292
Increase or decrease	590*	1,721*	3,580†
Number in Boston	137*	....	8,828
Increase or decrease	166*	308*	1,005

* Decrease. † Increase.

Street and Commercial Arcs.

	Street.	Commercial.	Total.
Number	13,991	12,384	26,375
Loss or gain	89*	1,165†	1,076
Percentage of total	53	47	....

* Loss. † Gain.

Conquest of the arc lighting field by inclosed arcs has gone rapidly forward during the year, as may be seen by the gain of 3,580 in the number of this type of lamp; while single open arcs lost 590 and double arc lamps, 1,721 of their number. At the close of the fiscal year, the electric lighting systems included 1,690 single open lamps, 6,066 double lamps and 19,292 inclosed arcs. Owing to the fact that not all of the lamps included in the electric systems are in use at any one time, the total number of these arc lamps, 27,048, was greater by 673 than the sum of public and commercial arcs. The street or public arcs stood at 13,991, having decreased in number by 89 during the year, but commercial arcs made a gain of 1,165 and closed with 12,384, showing a net gain of 1,076 for all arc lamps in use. Of these lamps 53 per cent. were devoted to public and 47 per cent. to commercial service.

Arc lamps continue to be rated at nominal candle powers that range from 500 to 4,000, besides ampere ratings of 1 to 20 in the case of inclosed arcs. For public lamps the rating by nominal candle power is still the favorite method, all save 459 of these lamps being so rated. Commercial lamps are more commonly rated according to the amperes taken, 64 per cent. of their number being on this basis. Among commercial arcs, 5 amp. was the most frequent rating, 31 per cent. of their total number having been of that capacity, while 2,000-candle power lamps followed with 19 and 1,200-candle power lamps with 15 per cent. Of the public arcs 45 per cent. were rated at 1,200, and 51 per cent. at 2,000-candle power.

Commercial incandescent lamps were rated at 2 to 150-candle power each, and their total number was 1,305,473 on all the lighting systems of the State. Of this number, 98 per cent. was made up with nominal 16-candle power lamps, and there were only 3,576 lamps of all higher candle powers. The tendency to use lamps of less than 16-candle power rating was very slight, the largest number in any one size being 5,430 lamps of 10-candle power. The total number of commercial incandescent lamps rose 16 per cent. during the year.

Incandescent street lamps like those in commercial service were mainly rated at a single candle power, but this rating for the street lamps was 25 instead of 16 candles. Of the 20,101 incandesent street lamps, 74 per cent. were of the nominal 25-candle power size, and 32-candle power lamps followed with 10 per cent. of the total number. Unlike arc street lamps, the incandescents increased in numbers during the year, the rise amounting to 9 per cent. of their number at the beginning. These incandescent street lamps have been shifted in the main from constant pressure alternating and constant direct currents circuits to lines operated by constant current transformers.

Public Arcs Rated in Candle Power.

Candle Power.	Number.	Candle Power.	Number.
1,200	6,312	1,600	26
1,500	2	2,000	7,170

Public Arcs Rated in Amperes.

Amperes.	Number.	Amperes.	Number.
5.5	320	6.6	139

Incandescent Street Lamps.

Candle power	15	16	20	24
Number	216	158	854	414
Candle power	25	30	32	40
Number	14,950	869	2,036	546
Candle power	50	64	65	75
Number	23	17	17	1

Commercial Arc Lamps.

Candle power	500	600	800	1,200
Number	1	5	16	2,085
Candle power	1,500	1,600	2,000	4,000
Number	2	60	2,306	6

Commercial Arc Lamps.

Amperes	1	3	4	5	6	6.8
Number	1	540	1,103	3,842	1,656	108
Amperes	6.6	7	10	15	20	..
Number	17	456	43	2	1	..

Commercial Incandescent Lamps.

Number	152	751	984	3,851	5,430
Candle power	2	4	6	8	10
Number	2,293	1,288,284	2,338	486	25
Candle power	12	16	20	24	25
Number	6	648	43	1	29
Candle power	30	32	50	65	150

Capacities of Connected Loads.

Load.	Kilowatts.	Percentage of total.
Arc street lamps	6,234	5.1
Incandescent street lamps	1,830	1.6
Commercial arc lamps	5,599	4.6
Commercial incandescent lamps	72,871	60.0
Electric motors	34,570	28.5
Total	121,101	99.8

To determine the total capacity of loads connected to the circuits of electrical supply systems, each kind of apparatus has its rating reduced to a kilowatt basis. For this purpose, it is assumed that the full load efficiency of all motors is 74.6 per cent., so that one kilowatt must enter the motors as electric power for each mechanical horse power delivered. With arc lamps rated at nominal candle powers, 0.25 watt has been taken as the rate of consumption per candle power. Arc lamps rated in amperes are assumed to operate with 80 volts each. All incandescent lamps of both the street and commercial sorts have been computed on the basis of 3.5 watts per nominal candle power,

Energy Income Per Kilowatt Capacity of Connected Load.

Loads.	Kilowatts.	Dollars income.	Dollars per kw.
Arc street lamps	6,231	1,410,812	233.
Incandescent street lamps	1,830	353,364	195.
Motors	34,570	921,786	30.
All commercial lamps	78,470	3,721,284	47.42
Total	121,101	6,578,598	54.

From these computations it appears that the total capacity of lamps and motors connected to electrical supply systems amounted to 121,101 kw. or 14 more than the corresponding load of the previous year.

Of the total capacity of dynamos at electric lighting stations, in 1902, the connected load was 143 per cent. Commercial incandescent lamps made up 60 per cent. of this load, having gained 1 per cent. in their relation to total capacity during the year. Electric motors represented 28.5 per cent. of the connected load and had lost 1.2 per cent. of its total in the preceding 12 months. Other items in the load each varied less than 1 per cent. as to its total when compared with those of 1901.

The year under review shows an increase of 5 per cent. in the number of poles included in electrical supply systems, and closed with this number at 116,004, of which 110,942 were set in public streets and 5,062 elsewhere. Meantime the length of underground conduit went up 11 per cent. to 1,257,855 feet, or 239 miles. At 50 poles per mile, the number just named corresponds to 2,320 miles of line, or 10 times the length of underground conduits. The underground conduits contained 8,968,798 feet of wire, or an average of 7.1 wires per conduit. The length of conduit added during the year was 25 miles, and of pole line, at 50 poles per mile, 120 miles.

Electrical supply systems within the State were operated by 66 companies that did only electric business, and by 24 gas companies during the year. The sum of stocks, bonds and notes outstanding against the companies may be taken as an approximate measure of their investments. This sum was greater by $6,267,190 for all the gas companies of the State than for the purely electric companies, but the electric assets of the gas companies stood at the sum of $4,064,594, so that the total investment in electrical supply was probably greater than that in all the gas systems. Extensions of the purely electric companies have been provided for by an increase of 8.4 per cent. on the face value of their stocks, 7.2 per cent. on their bonds, and 8.4 per cent. on notes payable. Comparing the electric assets of the gas companies with the assets of the purely electric companies, it appears that the latter have made 86.1 per cent. of the total investment in systems of electrical supply.

The surplus of all the companies doing a purely electric business amounted to 14.1 per cent. of their capital stocks at the close of the year, but the actual amount of this surplus was 28.1 per cent. less than that of 1901. Gross income of all electric lighting systems by whomsoever operated amounted to $6,642,309 for the year, representing a gain of 9.1 per cent. over the like income for 1901. Of the income named, 99 per cent. was derived from sales of electrical energy, and 1 per cent. from the rent of motors, meters and fixtures, and from steam heating. Operating expenses of all electrical supply systems amounted to 62 per cent. of their earnings, leaving a gross profit of $2,532,493. Of this profit the gas companies earned 18 per cent., leaving $2,142,920 for the purely electric companies. Incomes of the last named companies from jobbing and rents of buildings brought their gross profit up to $2,563,758, or 12 per cent. on their investments, measured by the sum of stocks, bonds and notes. Of the gross profits just named, interest absorbed 13.5, dividends, 47, depreciation charges 10.2, and sundry items 39.6 per cent., resulting in a deficit. The sum of dividends was $1,207,458, or 8.7 per cent. on capital stocks. Depreciation charges amounted to only $262,086, or 1.2 per cent. of the face value of stocks, bonds and notes, or 1.3 per cent. on the value of the assets of electric companies. These charges left a deficit of $269,714 in operations for the year.

The income of electrical supply systems was 87.3 per cent. of that derived from the sale of gas throughout the State, but gas street lamps earned only 9.8 as much as the electric.

Of all sales of electrical energy, that for commercial, arc and incandescent lamps by meter was the most important, and yielded 46 per cent. of the total energy income. Next in importance came the service to arc street lamps, which furnished 22 per cent. of the energy income. Sales of current for power purposes yielded 15.9 per cent. of the income, a gain of 1 per cent. over the previous year. Commercial incandescent lamps at contract rates earned only 3.5 per cent. of the total income, and commercial arc lamps on contract rates were credited with 6.8 per cent. of this total. Incandescent street lamps earned 5.4 per cent. of the energy income, or one-fourth as much as the arc street lamps. Arc and incandescent street lamps combined earned 27.4 per cent. of the entire energy income, or 1.2 per cent. less of this total than in the previous year.

Of the $4,109,816 expended in the operation of all the electrical supply systems during the fiscal year of 1902, 53.4 per cent. was represented by the outlay at the electric stations, 18.7 per cent by the cost of distribution, 13.1 per cent. went for offices and management, and 14.6 per cent. for miscellaneous expenses. The total of these expenses was 4 per cent. greater than that of the previous year. Fuel represented 48.4 per cent. of the entire expense at electric stations, and 22.8 per cent. of all operating expenses for electrical supply systems. The other items of expense at electric stations were made up of wages, 27.4 per cent.; rent of real estate, 4.4; steam plant repairs, 6.5; electric plant repairs, 4.9; station repairs, 2.4; water, 2.8; oil and waste, 2.1, and apparatus and machinery, 0.7 per cent. of the total there.

Taxes paid on all the electrical supply systems by whomsoever owned amounted to $341,822.87, and this sum is only 1.1 per cent. of the value of all assets of electric companies, plus the value of electric assets of the gas companies, according to their own statements. Current bought by electrical supply systems amounted to $33,672, a sum greater by 56 per cent than that of the previous year, showing the tendency to trade between the various companies and with electric water power plants.

Percentages of Energy Income from each Load.

Commercial arc and incandescent lamps by motor	46.0
Arc street lamps	22.0
Motors	15.9
Commercial incandescent lamps by contract	3.5
Commercial arc lamps by contract	6.8
Incandescent street lamps	5.4
All street lamps	27.4

Arc street lamps yielded an income during the year of $1,410,812, or $233 per kw. of capacity in those connected to the systems. Incandescent street lamps come next in relative income with a total of $353,364, or $195 per kw. of their capacity. The income per kilowatt from arc street lamps shows a decline of $13, and the like income from incandescent street lamps $18, compared with corresponding figures of the previous year. From all commercial lamps, both arc and incandescent, the income was $3,721,284, or $47.42 per kw. capacity, in 1902, this income

per kilowatt being more than $4 below that of 1901. In the case of motors the entire income amounted to $921,786, or $30 per kw. of capacity, this latter sum being $1 greater than that of the previous year. These incomes per units of connected capacity seem to indicate a general reduction in prices for electrical energy as represented by $54 per kw. capacity, in 1902, instead of $58 as in 1901.

Five of the electric supply companies did not earn enough to pay operating expenses during the year, and 25 more of the companies paid no dividend. The largest dividend paid was 50 per cent. on capital stock in the case of a company that sold its plant and went out of business. Two companies paid dividends of 10, and 9 companies 8 per cent. on stocks.

Notes on the Design of Central Station Records and Returns.[1]

By Mr. F. H. Davies.

The importance of well designed and carefully kept records in electricity supply work cannot be too highly appreciated, as by keeping the immediate state of things continually on the tapis, and affording an easy means of comparison with past results, they bear very largely on economical production. Methods of keeping records vary considerably at all stations. Of course, the fundamental idea must always be the same, but the different degrees of thoroughness that one sees show what diverse opinions engineers must hold on this subject. There is no doubt that the modern style tends towards elaboration of records. In the old fitter engineer days, not so very long ago in some cases, the subject naturally did not receive much attention, but with the growth of supply concerns it has been found of such vital importance that it has become the object of a great deal of very careful consideration by some of our leading authorities. Carefully designed records and plenty of them will reduce the whole working of a station to a system, and by so doing greatly promote economy and increase the interest taken in the concern by all who have to deal with them. Emulation is a very easily awakened trait in human character, and it is advisable, therefore, that practically every member of an electricity works staff should have something in the way of a record to keep—that is to say, one that can either be compared with another man's work or with previous results. If some engineers would take the trouble to educate their men into understanding a little of the theory of their work, better results might be easily obtained; too frequently men are treated as automatic coal shovelers or valve twisters, and all interest taken out of their work by keeping them in the dark as to its results. For instance, give a stoker a record to keep as to the weight of coal he consumes and the ashes he rakes out, and he will soon connect the proportions of the one with the other, and begin to understand the various classes of coal he may have to deal with, and the way to get the utmost value out of each.

The following notes do not pretend to go fully into the subject in all its branches, as this would entail the consideration of all types and sizes of stations under separate headings, a task that could only be satisfactorily performed by a committee of experts in each type. Representing, as they do, the practice in several well managed stations, it is possible that these notes may be of use to engineers engaged in designing records for new stations or in bringing old ones up to date.

Diagram Records.—It is common practice in cable specifications to require the contractor to keep a full and complete record of the progress of his work on a set of maps to a scale of 10 feet to 1 mile, noting the positions and sizes of all the cables laid. It is most important that this should be thoroughly and correctly carried out, as maps of this description are absolutely essential. In addition to the above, a book of squared paper should be kept, wherein can be drawn to a larger scale any very awkward part of the system, such as one where it has been necessary to pass through a tangle of sewer, gas and water pipes. The exact positions, size, and description of such pipes should be carefully noted, as later on an accurate knowledge of their whereabouts may save trouble and expense when opening up the ground for services or repairs. All services should be marked on the ordinance map directly they are put in, and, if possible, the exact point where they enter the house shown. In the case of 3-wire working, it is very desirable to have a series of rough maps of the distributers, showing the polarity of each service laid and the number of lamps connected to it. This, although only a rough guide to the balancing of the system, would be found very useful when used in connection with the balancing book, of which more later on. In all electricity works a diagram book should be kept, clearly showing all cable and pipe work connections right up to date. In a station of any size it is very difficult to carry all the connections and details in the head, and for a newcomer the trouble of learning them is greatly increased by having to grope in dark pits following out cable or pipe runs. The book should be readily accessible to the engineer in charge at any time of day or night, as in many cases of emergency it would be found very useful. Besides main connections, it should contain diagrams of any motor starters or such like apparatus that may be installed. In a large station with a great deal of piping, a working model of the chief parts of the system is very useful. It should consist of a slab of some hard material, with a diagram representation of the pipes painted on it; holes should be drilled in the positions of the valves, and red or black plugs inserted according to whether the valve is open or shut. The great use of this lies in the fact that an engineer when coming on shift can see at a glance exactly how the steam distribution stands, and so save a lot of time and perhaps some risk. Of course, such a system is of no use unless carried out systematically, and to make it a success strict orders must be issued that no valve is to be touched excepting with the orders of the engineer in charge, who should immediately personally alter the plugs and be solely responsible for the accurate working of the system. When a station is installed working drawings of the various machines, etc., are always provided by the contractors. These should be carefully indexed and kept in a proper receptacle, and added to from time to time as extra plant is put in.

Curves.—A system of well-thought-out curves kept strictly up to date is very interesting and necessary. There is practically no limit to the amount of comparative information that may be recorded in the shape of curves, but the extent to which they are used must, of course, be determined by local conditions and the discretion of the engineer. The following are a few that it is always desirable to keep:

Daily Load Curves.—These should be executed on separate sheets and should show the output in kilowatts over the 24 hours. The capacity of the machines running should be shown by vertical straight lines rising at the point where they are put on load, continuing horizontally during the time they are running, and dropping again vertically when the machine is taken out. The curve will then give a ready indication as to the manner in which the plant has been run, and will show if more than the necessary amount has been used at any time. A distinction should be made between the current going out to the mains and that going into the battery by a dotted line following the course of the former, the total machine load being shown by a full line. In a station where there is very much difference between the bus-bar voltage of the heavy and light loads, a line might be added somewhere on the curve showing this to scale. On the sheet there should be a space for remarks in which should be noted the units generated, the plant load factor for the day, and the maximum and minimum loads, also any untoward occurrence that may have had an effect on the general shape of the curve.

Costs Curve.—This should be constructed on a large linen-backed sheet, arranged to take one year's working, and should be got out from the weekly works cost sheet. Horizontally should be placed the dates of the ends of the weeks, and vertically 3 scales—one for the units generated, one for the lamp connections, and one for the works costs per unit generated. The latter should be very open, as some costs details are apt to keep close together. The costs to be taken into consideration should consist of 4 items—viz., coal, oil, waste, water and engine room stores, wages, repairs and maintenance.

The weekly progress in lamp connections should be shown, so that their effect on the units generated may be discerned. Of course, all the above curves must be of different colored inks. Every quarter a vertical line should be drawn across the sheet, and all the above items, excepting lamps connected, averaged by horizontal straight lines.

In addition to these, there should be shown, in their right positions on the scale if possible, the total units generated, total units sold, average works costs per unit generated, average works costs per unit sold, average total costs per unit sold, average revenue per unit generated and average revenue per unit sold. The sheet will then give a clear, detailed and averaged indication of the results for any quarter that should be very handy. As a matter of policy, this sheet should be accessible to every member of the staff, so as to maintain a lively interest in the progress of the undertaking. There are, of course, many other curves that will suggest themselves, but, as said above, the advisability of their adoption must depend upon local conditions. Where extensions are always going on, a curve of capital outlay per kilowatt would be of interest, or one of lamps connected per kilowatt installed.

Daily Log Sheet.—The variety of log sheets that one sees about does credit to the inventive faculties of station engineers. The way they differ in size and completeness shows the widely varying ideas that must

1. *Electrical Engineer*, London.

be held of the importance of the subject. At any rate, it is better to err on the side of over-elaboration than the other. It must be remembered that, although many items on a log sheet may be of little value as records, they all exercise a disciplinary effect on the staff by forcing them to take frequent readings of the various instruments. Of course, over-elaboration tends to lead to faking, but if each day's sheet is habitually gone into by the chief very carefully, this is liable to turn out rather a dangerous form of amusement. There should be only one log sheet in a central station in which should be incorporated the readings of the various departments, taken by the members of those departments, and reported to the engineer-in-charge, who must be responsible for the sheet as a whole. The majority of readings should be taken at least every half hour during the time of light load, and every quarter of an hour during the rest of the day. Leaving the items which are taken with the above frequency out of the question, we will consider those that are a little less usual and have a greater bearing on what may be termed the general management of the station. Space should be provided on every log sheet for a complete list of the staff on duty on each shift, and the sheet should be signed and certified as correct at the end of each watch by the engineer in charge. Note should be taken by the stokers of the temperature of the chimney gases, and the amount of the draught at stated intervals, at least once on each shift; and where superheated steam is used the same should be done, two readings being taken —one at the boiler stop valves and one at a central point in the main steam pipe, or at the engine stop valves. This will be of great value, as the loss of heat that is going on in the pipes will be constantly under inspection. If occasion arises to change over from hot to cold boiler feed, the times should be carefully noted, as they will bear considerably on the day's efficiency. There should be a place for maximum and minimum loads, and also for plant load factors.

Feed water temperatures should be read by the stokers at stated intervals, not less than three times a day, and reported to the engineer in charge, who should see that they are logged on the sheet. The hardness of the feed water should be tested once a day and logged. The times of blowing down economizers and boilers should be reported by the stokers and recorded. The amount of oil or other lubricant used should be entered at the end of each shift, also the weight of coal and ashes and the percentage of the latter to the former worked out for the day. In addition to logging the hours of running of each main set, in a large station it is desirable to keep a record of the running hours of each member of the auxiliary plant—that is to say, feed and circulating pumps, and stoker, coal conveyor and economizer engines or motors; boosters and balancers should also be included. To make this of any value it should be done systematically, and a space provided on the sheet for the running hours of each individual machine. All meters should be read at midnight, and there should be spaces on the log sheet for the entry of the readings. The whole sheet should then be worked out, and the majority at any rate of the following particulars of the day's working given: Total units generated; units put into battery; units taken out of battery; efficiency of battery, watt hour and ampere hour; units used on works; units sent out; pounds of coal per unit generated; pounds of water per unit generated; pounds of water evaporated per pound of coal consumed; evaporation from and at 212° F. It may be advantageous also to make a record of the weather in the log sheet, as it has such a great effect on the amount of current turned out.

Battery Log Book.—This is usually supplied by the battery contractors, and generally consists of a daily record of the battery charge, discharge and efficiency, and the results of a weekly examination of the battery, specific gravity and volts. Although some of these books as supplied by battery contractors are well designed, they very often will not fit in with the other station records, so that it is generally desirable to keep some separate form of log.

Diaries.—Every member of the staff who holds a responsible position should keep a diary, in which should be recorded any important event of the day that occurs in his particular branch—such as details of engine repairs, boiler cleanings, business transactions, and the like. Breakdowns should be outlined in the shift engineer's diary and reported on paper in detail to the chief engineer, who should file the reports; and in the case of a large station, where breakdowns of some sort are of fairly frequent occurrence, transfer a summary of them to the "breakdown book," which should consist of a series of columns headed approximately as follows: Date, time of breakdown; period of extinction, if any; nature of breakdown; probable cause; steps taken to remedy; name of engineer in charge; remarks.

Engine and Boiler Hour Records.—These are always kept in any well managed station and are very useful, as when made up each week they give an indication of the way the running has been spread over the plant and the time when boiler cleaning should be thought about.

Balancing Book.—The art of balancing a 3-wire network is one that requires a certain amount ot experience and a good system. It would be out of place here to go deeply into the question, but to explain the uses of a balancing book, it is necessary to touch on it slightly. Because two consumers have an equal number of lights installed, it does not follow that they will balance each other in practice. The hours and duration of lighting must be taken into account. In direct current working it is most important that the balance should be correct at the peak of the load. While this condition may obtain at one period of the year, it does not follow that it will do so at another, and as the mid-winter period is usually the most important, balancing should be so arranged as to give the desired state of affairs at that time of the year. There must, of course, always be a great element of chance in it, but the following arrangement of a book, in conjunction with the rough maps spoken of above, will be of great assistance. The book should be divided up into portions somewhat as follows: Public houses, hotels, long-hour private houses, short-hour private houses, offices, shops closing before 8 P.M., shops closing after 8 P.M., shops with houses attached, churches, public institutions, schools, all-night consumers, day consumers, workshops, motive power users. Each of these sections should be divided into two sides, positive and negative, and each side into spaces for the names and addresses, equivalent 8-candle power connected, and total equivalent 8-candle power connected for that description of consumer on that side of the system. When a new consumer comes along, after being classified, a reference to the book will show on which side he should go to help to balance the whole system, and a glance at the balancing maps on which side to help to balance his particular distributer. If both coincide, well and good; if not, it must be determined which is the most necessary to balance the whole system, or that section of distributer.

Free Wiring Book.—When free wiring is undertaken by the supply authority, it is desirable to keep a book that will show at a glance the amount of profit that is being made every quarter on the outlay. Of course, on the rental system this is not necessary, as it is a fixed and known amount, but where an extra price per unit is charged, it is very handy to have an easily looked-up record of the several consumers' paying qualities. A page should be set apart in the book for each consumer, and quarterly entries made under the following headings: Number of points, number of switches; number of lights (equivalent 8-candle power); total wiring costs; revenue from extra charge; rate of gross profit per cent. per annum. If the free wiring is let to a contractor, a column should be included showing the contract price per point, and if carried out by the supply authority, one showing the average cost per point.

House Service Costs.—A careful record of these should be kept by the the mains' engineer, apart from that which will be found in the stores' book and time sheets. It should include the cost of meters and all apparatus on consumers' premises, all cable and material used, and men's time totalled up, so as to make a handy reference, and save the trouble of picking out the separate items from the general books if information is desired about any one service.

Meter Cards and Books.—Meter cards may either take the shape that their name implies—that is, of a plain card—or of a small book of three or four leaves. In either case they should contain the consumer's name and address, meter number and size, and the usual columns for the readings and initials. It is advisable to print on the back or inside of the cover a few of the chief points in the agreement form—such as those relating to alterations and additions to the lights, inspection, payments, and receipts. In a conspicuous place—say at the head or foot of the card or cover—should be printed in red ink an intimation that any defect in the wiring or apparatus should be at once reported at the electricity works. The meter reader's book is best made up somewhat on the card system—that is to say, by a series of separate sheets, one for each consumer, the whole being fixed in a binder. This allows of the book being kept respectable, and of alterations being made without scoring out or erasing. All entries in this book, as well as on the meter cards, should be made in indelible pencil. The leaves should be divided up into the same columns as the meter card, and it should be impressed on the meter reader that the remarks column is for use, and that the least defect should be reported therein. At the end of the quarterly round the readings should be transferred into the office meter book, which on each consumer's page, in addition to the readings, should give full details as to any changes that may have been made in the size, number or type of the meter. The quarterly accounts can be worked out from this book.

Canvassing Records.—Canvassing plays a very important part in the political economy of many electricity works, and when this is the case a proper system of records is necessary. Before canvassing is undertaken, a list of every house in the district that is to be worked should be made out. This can perhaps be best done by aid of the card system, each house having its own card. On this card should be recorded the date and results of calls, as this information will be of use when the place is again canvassed later on, enabling the canvasser to open negotiations at the point they were dropped. At the end of each week the canvasser should make out a report of his work on a sheet containing the following information: Streets canvassed, number of calls made, number of applications signed, amount of salary and expenses for the week, cost per application signed, remarks. This sheet should be examined by the engineer, who will then see exactly what the obtaining of consumers is costing, and therefore whether the canvassing is worth while or not.

Application Forms.—These do not vary much in general design. As a rule they consist of a foolscap sheet perforated down the middle, each of the two sides containing the agreement for supply and the general conditions. The consumer keeps one-half and the supply authority the other.

General conditions will often be found to vary somewhat in detail, and it seems rather a pity that standardization cannot be effected here, as to a very great extent has been done in wiring rules. Clauses containing the following points are inserted; voltage, price, service lines, testing, meter rents and questions as to accuracy, wiring, access to consumers' premises, additions and alterations, interruption of supply, disconnections, leakage, liability of consumer for damage to apparatus, payments and receipts. The application form contains spaces for the consumer's name, address, and description of premises, and if a shop, the hours of closing should be noted. Then follow the number and candle power of lamps, and sometimes the sizes of the motors it is proposed to install, the date the premises will be ready for testing, wiring contractor's name, and the consumer's signature under a carefully worded form of agreement. The correct wording of this latter is very essential, and it should afford no loophole for dishonesty on the part of the consumer, or sharp practice on the other side.

In anything but a very small undertaking it is generally best to have a separate application form for motive power, as if the proposed installation is of any size, the lighting general conditions will hardly apply. For instance, there should be a clause stating the maximum percentage of starting current over the normal working current that is allowable, and this should never exceed 33 per cent. It should also be provided that the starting switches, etc., must be approved by the engineer. These agreements, it should be noted, are not legal documents until stamped at Somerset House with a 6d. stamp. In free wiring agreements it is necessary that the landlord or owner of the premises should certify in writing that he is willing for the installation to be put in or to be taken out in the event of the tenant leaving or discontinuing the supply. There should also be a schedule in the agreement clearly stating the number and positions of the lamps that will be installed, a clause to the effect that the consumer must keep the installation in good repair, and a clear understanding as to the terms of purchase.

Mains Extensions.—When large mains extensions are taken in hand by the supply authority, it becomes necessary to keep a full detailed record of their daily progress and the amount expended on them. This can best be done by aid of a sheet divided up into suitable headings, such as date, name of street, yards of trenching, yards of pipe, conduit or troughing, number of bends, number of bell mouths, number of boxes or joints, yards of cable, cost of materials, cost of supervision, cost of labor, cost of sundries, total. Some such return as this, which always keeps the state of affairs directly in front of the eye, will be found of service in keeping down costs, and also in estimating for future extensions.

Meter Testing Records.—The results of meter tests should be carefully preserved in a systematic manner, and a book should be set aside for this purpose, arranged in the following way: Date, number and type of meter, size of meter, where from, where for, starting current, error, remarks. If preferred, the details of the test can be included, but all that is actually wanted is the result.

Mains Testing Records.—These are extremely important, and must be very carefully kept. Presuming that it is customary to periodically test each section of feeder or distributer between the boxes, each of these lengths should be taken separately, and have a portion of the test book allotted to it. The tests that are necessary and the manner of recording them will, of course, differ considerably with the system employed, but what is wanted will be sufficiently obvious to the engineer.

Indicator Cards.—It is the custom at most stations to periodically indicate the engines at various degrees of load, but too often the cards are either put away in a drawer anyhow or left about; consequently they are of very little value for future reference. Directly they are taken, the outline of the curve should be dotted in with ink, so as to maintain a permanent record, and the card with the results of the working out and all details on it pasted into a guard book in such a manner as to allow of its being turned over to get at the information on the back. The guard book should be of the type that is used for newspaper cuttings.

Consumers' Register.—This is a very important book, and should be carefully designed so as to include as many of the following details as may be applicable to the case: Consumer's application number, consumer's connection number, name and address, description of premises, date of application, date of service, date of testing, date of connecting, insulation test, number of lamps installed of various candle powers, arcs and sundry apparatus; size of motors in kilowatts, equivalent 8-candle power installation, meter and demand indicator size and numbers, reading of meter when installed, side of system, section in balancing book, size and length of service cable, wiring contractor's name. remarks. The above is rather a formidable list, but it must be taken as an outside estimate of what is required. No doubt some of the items could be eliminated in many cases, but it is always as well to centralize as much information as possible in the consumer's register, so as to have everything handy. Each consumer should have a space of at least half a dozen lines in the book, so as to allow for alterations or additions to the lights.

Weekly Returns.—At all central stations the results of the week's working are incorporated in a sheet made out in a more or less degree from the daily log sheets and from the stores books and time sheets. This return should be as complete as possible, and should show the following details: Maximum load on plant, maximum load on feeders, battery charge in ampere hours, battery discharge in ampere hours, battery efficiency, station load factor, plant load factor, total number of consumers connected, equivalent 8-candle power. There should be a summary of results containing, total units generated, total weight of coal consumed, and cost, total amount of water used and cost, cost of oil and engine room stores, cost of repairs and maintenance, total amount of revenue wages. Each separate item should then be worked out into cost per unit generated, and the whole totalled. In addition to the above should be stated units used on works, public lighting or other units, weight of coal per unit generated, weight of water per unit generated, water evaporated per pound of coal consumed. A space should be left for remarks, in which should be recorded any event that has had a notable effect on the costs, and any items of general interest. If preferred, the whole of the above may be in duplicate, allowing a space for the "corresponding period last year."

Quarterly Returns.—The number of these is very great if every department of a central station is taken into account. It may, therefore, suffice to deal with the one that interests the engineer most—viz., that which is practically a summary of the above weekly sheets, with a few other items of importance added. The return should be divided up into several portions, more or less as follows:

Output.—Units generated, units used on work, units sold for public lighting, units sold to private consumers, units unaccounted-for, percentage of total units sold and units generated, units sold per lamp connected, maximum load on station, maximum load on mains, load factor for quarter, diversity factor (if maximum demand system is used).

Consumers and Lamps.—Applications signed during quarter, total number signed, total number of consumers connected, equivalent 8-candle power of lamps connected during quarter, total lamps connected (equivalent 8-candle power).

Balance Sheet—Income.—Units sold at various prices and amounts received; received from meter rents, etc.; received from sundry sales; total revenue recipts.

Expenditure—Works Costs.—Coal, water, oil, etc.; repairs and maintenance; wages; total works costs.

Standing Costs.—Directors' fees, salaries, general establishment charges, stationary and printing, insurance, rents, rates and taxes; total standing costs; total costs.

The following items should also be noted; average revenue per unit generated, average revenue per unit sold, percentage of total costs to total income.

Time Sheets.—In order that men's time may be easily and correctly apportioned to the several costs headings, it is necessary that a good system of either daily or weekly time sheets should be used. In the former case all that is wanted is a slip divided into headings for description of work, times of starting and stopping, and allocation num-

ber. The two former should be filled up by the workmen, and the latter by the clerk. At the end of the week the slips can be transferred to each man's weekly time sheet, which may be arranged with the daily time on one side, and the allocation on the other. If preferred, instead of using daily slips, the weekly sheet may be intrusted to the workman for him to fill in his time and description of work, the allocation being done in the office.

There are many other records and returns than those enumerated above, which might be considered—as, for instance, stores books; but this item alone, if gone thoroughly into, would take up a prohibitive amount of space; besides which it belongs more to the clerical side, which this article does not pretend to touch on. The methods delineated would in many cases have to be amplified, and in some curtailed, but it is trusted that they will be useful at any rate as a basis whereon to build up a suitable system.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, May 9th, 1903.

The Welsbach Company.—The New Gas.—The Life of Retorts.

The spectacle of a body of shareholders enthusiastically supporting and indeed cheering a board of directors who meet them, not only with the statement that the position of affairs does not warrant the payment of a dividend, but also with a proposal of such a drastic nature as the reduction of capital to the extent of two-thirds, shows a different state of feeling to that which one naturally would expect under the circumstances, and it may be regarded as creditable to all concerned. As a rule, the shareholder's state of mind is influenced by the size of the dividend bag, and it is pleasing to see a body of men rising beyond the narrow view of "The dividend for the year ended 31st December, last," to take a wider view of their position and responsibilities. The average shareholder, having received a full dividend, is apt to drivel into meaningless complacencies, respecting the chairman, the directors, the manager or anyone else who happens to come before the board. If it was the name of the office boy that came up he would find it difficult to refrain from a reference to "The remarkable abilities of our energetic young friend who so ably polishes the bell pull;" and when there is no dividend he is apt to run to the other extreme, and hint darkly about the need for fresh blood on the board, a sweeping reduction in the overpaid but underworked staff, etc. After running the round of this sort of thing for years with but little break in the monotony, it is a refreshing novelty to find a strong board tackling a difficult situation, and receiving the practically unanimous support of the shareholders. And no better assurance could be given of the fact that the gigantic concern, the doings of which have been matter for comment in these letters on several previous occasions, is now under able and competent management, and as such will run in the same direction, and not contrary to the interests of the gas industry.

There is no good to be done in raking up the past history, with a view of showing how the capital responsibilities were piled up to the enormous sum of over 3¼ million sterling, which was the position that the present board had to face. Taking a careful valuation of the stock, cash and all tangible assets on the 31st March last, they arrive at a total of £450,000, and they value the good will at £900,000, making a total of £1,350,000. Their proposal, which was accepted by the shareholders, is to cancel the existing capital and issue in its place 600,000 cumulative 6 per cent. preference shares of £1 each and 745,000 ordinary shares of £1 each. One reason which may account for the satisfaction of the shareholders is that, although there is no dividend this year, there is a good prospect for the future. Sweeping reforms have been affected in regard to the working expenses, with the result that the loss of nearly £30,000 in 1901 has been changed to a profit of £45,000 in 1902, considerably more than sufficient to pay the preference dividend on the new capital, and this, notwithstanding the reduction in price of mantles and burners which came into effect last June, and which represents a reduction in revenue of some £30,000.

The aggressive, litigious policy of hailing up small shopkeepers to the chief law courts to answer charges of infringement has given way to the more rational plan of keeping up the quality of the mantles. The directors are taking care to maintain the pre-eminence of their manufactures, and as evidence of success in this respect, mention the fact that with a largely increased output there is a decrease of 20 per cent. in the defectives returned. In this matter they have the hearty support of gas companies, most of whom are concerned to a greater or less extent in maintenance, because in practice the mantle is paid for twice over, the labor and incidental expenses attending each renewal being as much as the cost of the mantle. Consumers are already appreciating the endeavors of the Company in this direction by exhibiting a preference for the Welsbach article as against cheaper makes. The most interesting paragraph in the report from our point of view is the statement that the board have acquired an exclusive license for a new process of manufacture which they believe will enable them to place upon the market a mantle superior in point of illumination and durability to any yet produced. This is the great need of the day, or should we say, the night. Already our largest undertakings are counting their annual consumption of mantles in seven figures. In small towns the gas company take the equivalent of 4 or 5 *per capita* per annum. As regards illuminating duty the mantle is already far ahead of anything else. But a substantial increase of durability would mean an enormous increase in the maintenance trade. The new mantle, I am told, will be on the market at midsummer.

Perhaps the most noticeable change in progress is the attention that is being directed to new "processes" for gas making which seems to augur that the set of retorts, so long the only method in practical use, for generating illuminating gas, will no longer reign supreme, but share that honor with all sorts of generators, cupolas, etc. As much may be said with regard to coal, which will no longer remain the sole staple material, but be assisted by oil, petroleum, coke, steam, and anything and everything that will furnish hydrocarbons, either singly or in conjunction with something else.

Until within the last few years, coal and retorts comprised the alphabet of gas makers. One or two carburetting or enriching processes had a look in now and then in a shamefaced sort of way, but did not stay long. The first important rival in a practical way was the water gas cupola, which gradually established a footing on a respectable scale. About the same time came the fuel gas question. There was not only gaseous firing for retort furnaces, but it began to be used on a large scale in other industries. And the operations in connection with blast furnaces, coke ovens, and power gas schemes have left their mark on the minds of gas engineers. Previously to the opening up of this new chapter, improvements were directed mainly to increase of illuminating power, with the object of reducing the proportion of cannel or other expensive coal that was indispensable in order to maintain a 16 or 18-candle power standard. But the concurrent advent of the incandescent burner has led to new ideas. Under the old regime the sole end or aim was to get the product up to condition to walk the chalk line in the official testing room. Photometrical value was everything, heating value nothing; but now the idea is to get a cheap low quality gas.

Two of the London Gas Companies, the South Metropolitan and the Commercial, have lately reduced their standard to 14 candles, and this year a suburban Gas Company, the Crystal Palace District, are applying for a 13-candle standard. The evidence in favor of this procedure was heard before a House of Commons Committee a few days ago, and included statements of opinion from various authorities, which show the direction in which things are moving. Sir George Livesey gave an unmistakable pronouncement as to his views. He said that he did not like carburetted water gas. It was an unscientific way of making gas, and certainly a most expensive one. Reductions as to illuminating power and purity were all very well when gas was practically the only available source of artificial light, but were not wanted now that the consumer could take his choice. Gas companies should be free to meet the requirements of the customer, who would go to some other form of light if he could not get what he wanted. The experience of the South Metropolitan Gas Company was that the 14-candle standard was too high to enable the consumers to have the full advantage of cheap gas, and he admitted there was no finality in 13 candles. It was merely a tentative step. The Chairman of the Committee, Sir John T. Brunner, was equally outspoken. He evidently fully recognized that the consumer can take care of himself, and that if he cannot get what he wants he has other resources. He asked why 8-candle gas could not be made in this country as well as on the Continent, and was told that the Parliamentary obligations were the only restriction. He made the remarkable statement that "If he were in the witness chair, he would give it as his opinion that it would be an enormous advantage to the country were the quality of the gas reduced to 8 candles." Prof. Vivian B. Lewes said that 13-candle gas was the ideal gas. He also mentioned that, with the incandescent burner, light could be obtained from a photometrically non-luminous or blue gas. He had never seen an incandescent burner giving a 100-candle light while consuming producer gas of 150 B.T.U. Mr. S. Y. Shoubridge, the Engineer to the Company, said

that the average calorific value of a 15-candle gas was 546 B.T.U., and that of a 12¾-candle gas was 537 B.T.U. He would not object to a calorific test or standard, but he would not care to be working under two standards, and he believed that in 10 years' time the calorimeter would be more important than the photometer. Some endeavor was made by the local authorities to make up a case in favor of high candle power, but their arguments had none of the force or point exhibited by the foregoing. There was the usual grandfatherly solicitude for the flat flame user. which hobby has been a source of enormous expense to gas companies directly, and to gas consumers indirectly, over the last 50 years. But surely the time has gone by when the flat flame user can claim the front seat. He is now not only in the minority but is a decidedly diminishing quantity. A large proportion of the gas supply is used in engines, stoves and technical appliances. We have just been noticing the extended use of the mantle. And these taken together represent a decided majority, and as such are entitled to claim first consideration in any representative action of the interests of gas consumers.

The point of all this is that gas engineers want a new process. Some year or two back Mr. Webber lectured before the Gas Institute on "A New Gas," which was in fact none other than the 8-candle gas above alluded to, as supplied in Germany, and the gas is a new gas in the sense that it cannot be manufactured with ordinary retorts, either vertical or horizontal. Many of the principal features of present processes may be retained, but radical changes are bound to come before long. Prof. Vivian B. Lewes is to lecture before the Gas Institution next month, and it is stated that his subject will be "Candle and Calories," from which it may be expected that he will further elucidate these important considerations.

Considerable attention has been attracted to a report presented to the Edinburgh Gas Commissioners by their engineer on the subject of the comparative life of horizontal and inclined retorts, which goes to show that the latter last twice as long as the former. But the inclines have only been at work 782 days, which is not a remarkably long life. And it would appear that there is something in the air of Edinburgh or of Edinburgh gas works that is very inimical to horizontal retorts. Taking the actual purchases over the last 14 years, the working life of a horizontal retort works out at less than a year, or about 350 days. This is such a very low result that the general idea is that there must be some mistake. Many claim to get a life of 2,000 working days, and, of course, a great deal depends upon the temperature and methods of working, but 1,500 days would certainly be a low average. This being the case, the inclined retorts have not been at work long enough to enable any opinion to be formed as to the question of durability. It is difficult to see why it should not be as easy to get as much work out of a retort on the horizontal, as out of one inclined at 32°, or where the question of durability comes in, as between the two. Durability is more of a matter of regular heats and skillful working than of the angle at which the retort is set, and is also a matter of make per ton. Some engineers are satisfied with 9,500 cubic feet per ton, while others want 11,000, and in the second case it stands to reason that the "durability" must necessarily be less. It is always unsafe to pick out one item for comparisons of this kind. The primary object of gas engineering is not a big make, or a long life to a retort, and there is not always an agreement between the working results and the financial ones. The biggest make does not necessarily mean the largest profit.

Labor in New England.

Iron Age notes that the labor situation among the metal trades of New England gets less and less threatening as the days go by. The troubles of the boiler manufacturers are ended practically everywhere. There are no prospects of a machinists' strike, so far as can be learned. In Worcester, where the Machinists' Union made demand for a 9-hour day last week, no answer has been given by the employers, and nothing further is planned by the union, its members say. The great majority of the Worcester machinists have nothing but criticism for the demand.

In Providence the demand made in the middle of April by the Molders' Union for a shorter day and larger pay has gone no further than a demand. Vice-President Valentine of the national organization of molders has been in the city several times, and has talked with some of the employers of molders. He has urged that the employers organize, that their association may treat as such with the union, but, of course, the employers do not agree to the expediency of treating with the union as such, preferring to deal with their men as individuals. There will be no molders' strike in Providence this year, unless conditions change very greatly.

The strike of structural steel workers employed at the Builders' Foundry is ended, the men having gone back to work. The company did not grant the demands for a shorter day and 40 cents an hour. But there was a conference between some of the men and the officials of the company at which the officials stated that on looking over their pay roll it was found that some of the higher waged men were not getting as much as might reasonably be paid them, and that the company were willing to pay such men more wages. On the other hand, they were unwilling to pay other men more than they were getting. It was a case of treating the men as individuals and not as a union. The result of this was that the men, or at any rate the skilled workmen and nearly all of the less valuable men, went back to work, and all is harmonious again.

Thus incipient labor troubles which threatened to inconvenience the metral trades have been removed, so that to-day New England is freer from labor troubles than for several years. The strikes of plumbers in various cities are ending, generally by a compromise. Compared with New York the building trades generally are free from strikes. Southern New England still has its troubles, because of the reference card. Massachusetts and Rhode Island are better off, and the Northern States have hardly any cloud on their labor horizon.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Cruse-Kemper Company, with office quarters in Philadelphia and well-equipped works in Ambler, Pa., has been incorporated. It proposes to engage, among other lines, in the construction of gas works apparatus. The latter division of its business will be under the direct charge of Mr. Arthur R. Cruse, who is well known to the gas fraternity from his active connection with the firm of Deily & Fowler, which connection lasted over a period of more than 20 years. The officers of the Company are: President, Arthur R. Cruse; Treasurer, A. E. Kemper; Secretary, Frank Flavell.

AT the annual meeting of the shareholders in the Richmond (Ky.) Water and Light Company the following officers were chosen: Directors, J. A. Sullivan, J. S. Walker, R. E. Turley, A. W. Merrill and Wm. W. Mason; President, J. A. Sullivan; Secretary, R. E. Turley, Treasurer, A. W. Merrill; Superintendent, B. R. Daugherty; Cashier, Mary Sullivan.

A CORRESPONDENT incloses the following: "The new schedule of prices for gas agreed upon between the Mayor and Common Council and the Poughkeepsie (N. Y.) Light, Heat and Power Company, will go into effect June 1, and from the rates it would seem that the Company makes a liberal concession. According to the new rates it is shown by the books of the Company that the bills of about 2,000 consumers will be reduced, while those of about 500 consumers will be increased. The increase will apply solely to those who use gas principally for cooking purposes only. The new rate will mean a loss to the Company at first, but this loss they expect to make up by increasing the volume of business through a broad and liberal policy toward the consumers. There is no distinction between the prices for gas used for heating purposes and that used for illuminating purposes. The schedule of prices will be as follows: For the first 5,000 cubic feet of gas, $1.35 per 1,000; for the second 5,000 feet, $1.25 per 1,000; amounts above 10,000 feet, $1.05 per 1,000. On all of these rates there will be a discount of 5 cents per 1,000 for payment within 10 days of the date the bill is submitted."

MR. JOHN N. PUGH, for a lengthy period prominent in the financial and commercial life of Baltimore, Md., died at his home in that city the morning of the 19th inst. Deceased was for many years an important factor in the management of the old Baltimore Gas Light Company, and retained a good financial interest in its successor, the Consolidated Gas Company.

ADVICES from Washington, D. C., are to the effect that at the special meeting of the shareholders, to consider the advisability of indorsing the action of the Directors who recommended the distribution of a certain special dividend amounting to $20 per share, the project was unanimously ratified. It was further provided (the dividend will result in an increase of $2,600,000 in the capital stock) that this amount be paid only in certificates of indebtedness of the Company. These certificates are to be issued in denominations of $20 each, or multiples thereof, and to bear 6 per cent. interest and to be subject to redemption

at the option of the Company, after the expiration of 5 years or to run for 20 years. For the purpose of the payment of this dividend the books of the Company are to be closed June 15 and remain closed until July 1. No dissenting vote was cast, about 75 per cent. of the 130,000 shares being voted. A meeting of the Board of Directors followed that of the stockholders.

UNDER the license law recently established in San Francisco, Cal., every gas or electric company doing business in that city shall pay into the city treasury a certain sum per annum based on the earnings per quarter. The scale is as follows:

Receipts per Quarter.	Tax Rate per Quarter.
$500,000 or over	$251.00
300,000 and less than $500,000	151.00
200,000 " " 300,000	101.00
125,000 " " 200,000	66.00
75,000 " " 125,000	41.00
50,000 " " 75,000	26.00
30,000 " " 50,000	19.00
20,000 " " 30,000	13.00
10,000 " " 20,000	8.00
5,000 " " 10,000	6.00
1,500 " " 5,000	4.00
Less than $1,500	2.00

MESSRS. CHARLES CLASS, Joseph Straubmiller. H. C. Rumpp, Chas. Strickler, C. Schmoerer, Philip Halbach and William Erb, all of Philadelphia, are anxious to build a gas works at Sea Isle City, N. J. The local Council has awarded them the necessary franchise.

PRESIDENT CONVERY, of the Perth Amboy (N. J.) Gas Light Company, says that the extension to Woodbridge will be completed by July 1st. The work cost upwards of $15,000.

THIS should be official respecting the rumor put forth that the Lynn (Mass.) Gas and Electric Company had been disposed of at a certain figure—the statement was made by the Companies Treasurer: "There is absolutely no truth in the statement that an offer of $500 a share has been made for the control of the Lynn Gas and Electric Company. There has not been any transfer of our stock for 18 months, the last sale being made at $238 a share."

MR. ROBERT HARWOOD, who is now in active control of the gas supply of Natick, Mass., has very wisely determined to retain Mr. N. O. Goulding as Superintendent.

THE Directors of the Laclede Gas Company, of St. Louis, Mo., have declared the regular semi-annual dividend of 2½ per cent. It is payable the 15th inst.

MR. JOHN H. BROWN is to have, as its Vice-President, active charge of the affairs of the Rochester (Minn.) Gas Light Company. Many improvements in the service are being arranged for, and one "betterment" that is virtually completed is the hiring of convenient and suitable business offices in the Horton block.

A CORRESPONDENT in Columbus, O., forwards the following under date of May 22: "The Columbus Railway and Light Company will make no effort at present to lease the property of the Columbus Gas Company, which controls both the artificial and natural gas companies in this city. Superintendent Johnston, of the Columbus Gas Company, said some days ago that, from the articles of incorporation of the Columbus Railway and Light Company, one would be led to believe that the new Company contemplated taking in the Gas Companies. While a proposition looking towards the leasing of the Gas Companies might be made at some future date, the large stockholders of the Gas Company had not been approached. Mr. Johnson said that the artificial gas plant would be in operation for one year at least, as the Directors at their last meeting had voted to continue its operation until the close of the fiscal year ending March 30, 1904."

THE new proprietors of the Hagerstown (Md.) Gas Company have elected the following Directors: Samuel B. Loose, J. Clarence Lane, Albert Heard, Geo. B. Oswald and J. A. Mason.

ON and after July 1st the charge for gas in the Yonkers (N. Y.) district of the Westchester Lighting Company will be $1 per 1,000 cubic feet.

AT the annual meeting of the shareholders in the Port Huron (Mich.) Gas Company no change was made in the official management.

THE following respecting a certain happening that was recently reported from the office of the municipal lighting department of Holyoke, Mass., is given for what it is worth—Manager W. H. Snow, of course, would know all about the case: "Probably the strangest kicker presenting at the gas and electric department office in the municipal building this year, was one who wailed because the total amount of his bill was not larger. Had it been but a couple of dollars more, he would have got a 50 per cent. discount that would make his net payment smaller than the bill he liquidated with a 40 per cent. discount. The good citizen moped around the office and wondered if it were not possible for him to return and turn the lights on for a few days so as to bring the amount up to the necessary figure to obtain the largest discount. After a consultation with Manager Snow, the young men in the office found it impossible to consent to the scheme. The bill was paid and the resident is still studying the 'wonderful' system of discount prevailing in the lighting department. There is a suspicion that for the next month, as a test, there will be a considerable waste of gas in this man's house."

MR. GEORGE H. WARNKING, who has the franchise for the construction and operation of a gas plant at Berlin, Wis., has determined to instal a coal gas works, and construction will be commenced thereon this summer.

A CORRESPONDENT in Rochester, N. Y., forwards the following under date of May 25th: "Last week City Clerk Pulver received from the Rochester Gas and Electric Company, a statement of the earnings of its subways rented to other corporations maintaining wires. The period covered in the report is the year beginning March 31, 1902, and ending March 31st last. Under its contract with the city the Company is obliged to file an annual statement of its income from rentals and the report received to-day will be presented at the next Council meeting. The income from subways during the year included in the report was as follows: Rochester Railway Company, $4,743.21; Rochester Telephone Company, $11,614.56; Central Light and Power Company, $223.24; Citizens Light and Power Company, $51.20; Rochester Gas and Electric Company, $13,806.10; total income, $30,438.31. The expenses of maintenance are also given for the fiscal year beginning March 31, 1902, as follows: For labor—April, $172.16; May, $170.76; June, $168.45; July, $55; August, $38.25; September, $22.50; October, $46.52; November, $26.70; December, $128,55; January, $248.05; February, $218.97; March, $139.92; executive and legal expenses for year, $1,000; use of horse and wagon for year, $200; franchise tax, estimated, $7,869.04; total, $10,444.87; net earnings, $19,993.44. It will be seen that the net earnings of the subways for the year were in the neighborhood of $20,000. The report also includes a statement of the money paid out in laying new subways during the year. The total expense of all subways laid by the Company up to March 31, 1902, was $393,859.35, while a year later the subway construction had cost altogether $410,969.24. This means that during the year ending March 31st last subways were laid valued at $17,109.89. The city has the authority at any time to buy the subways of the Company at their actual cost together with the price of maintenance after construction, less any depreciation in value, and for this reason the Company is obliged to report each year on the actual cost of the subways laid."

THE Essex and Hudson Gas Company, the Hudson County Gas Company and the South Jersey Gas, Electric and Traction Company, all of New Jersey, have agreed to accept the provisions of the offer of the Public Service Company, whereby they lease themselves to the latter for a period of 900 years, under a graded guarantee dividend rental, commencing at 3½ per cent. per annum going to a maximum of 8 per cent. per annum.

THE plant of the Loomis-Pettibone Gas Machinery Company is to be constructed on the site formerly occupied by the race track of the Linden Blood Horse Association. Linden is just southwest of Elizabeth, N. J., and it certainly is an advantageous place for the works of the Company named.

THE A. H. WOLFF GAS RADIATOR COMPANY has been incorporated in New York by Messrs. A. H. WOLFF, George H. Pond and Louis Wolff. It is capitalized in $20,000.

THE proprietors of the Hutchinson (Kas.) Gas Company report that gas ranges are rapidly replacing stoves of the gasoline type in the homes of Hutchinson.

THE AMERICAN
GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
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EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 42 Pine Street, New York.
Telephone, 2996 John.

TERMS:
SUBSCRIPTION—Three Dollars per annum, in advance.
Single copies, 10 Cents.

MONDAY, JUNE 1, 1903.

The Market for Gas Securities.

The heading is a misnomer, for there was no market, at least for city gas shares, this week. Consolidated sold ex-dividend of 2 per cent. at 196 to-day (Friday) and closed at 196½ to 197½. The spectacle of a stock such as this is, backed by millions of dollars of real estate and cash, to say nothing of its works, etc., selling at the quoted price must make the National City Bank men smile as they gather it in. In a market like this, however, it is futile to talk of real values. So we will take leave of the subject by remarking that Consolidated is cheap.

Brooklyn Union is nominally 205 to 210, but no sales are made in it. Cincinnati Gas and Electric remained firm, despite the fact that General Hickenlooper handed in his resignation as its President. Ill health was the reason for his action. He remains on the Board of Directors. Bay State, of Delaware, is in the hands of a receiver—his load we fear will not be a heavy one to carry—and the certificate distribution by the Washington (D. C.) Company has been satisfactorily arranged.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JUNE 1.

☞All communications will receive particular attention.

☞The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$78,177,000	100	196½	197½x
Central Union, Bonds, 5's.	3,000,000	1,000	109	111
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	300	310
Municipal Bonds	750,000	.	..	
New Amsterdam Gas Co. ..				
Bonds, 5's	11,000,000	1,000	108½	109
Northern Union, Bonds, 5's.	1,250,000	1,000	104	107
New York and East River				
Bonds 1st 5's	3,500,000	1,000	112	113
" 1st Con. 5's	1,500,000		109	111
Standard	5,000,000	100	181	..
Preferred	5,000,000	100	152½	..
Bonds, 1st Mortgage, 5's	1,500,000	1,000	115½	118
Yonkers	299,650	500	130	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	205	210
" " Bonds (5's)	15 000,000	1,000	119	119½
Bay State	50,000,000	50	¼	⅝
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	7	10
" " Bonds, 5's	5,250,000	1,000	73	76
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Centra , San Francisco	900,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co..	29,500,000	100	98½	99
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	101	101½
Columbus (O.) Gas Lt. & Heating Co	1,682,730	100	88¾	89⅛
Preferred	3,026,500	100	107½	109
Consumers, Jersey City Bonds	600,090	1,000	100	102
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	68¾	69
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's.	1,000,000	..	..	..
Equitable, 1st 6's.	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	85	87
Consolidated G. & E. Co.'s. Little Falls, N.Y.	90,000	100		100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,825,500	50	..	89
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	982,000	1,000	77	79
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	70	80
" Bonds, 6's	2,650,000	..	102	104
Jackson Gas Co.	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	97	.
Preferred	2,500,000	100	100	..
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100		60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	130	140
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	107½	108½
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	184¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105¾
New Haven	1,000,000	25	300	325
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	.
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	100	100¼
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	51½	52
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	95	96½
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	42	45
Bonds	2,047.000	1,000	98½	99½
Washington, D. C	2,600,000	20	437	440
First mortgage 6's	600,000	..	..	..
Western, Milwaukee. Bonds, 5's	4,000,000	..	109½	110
Wilmington, Del.	600,000	50	232	

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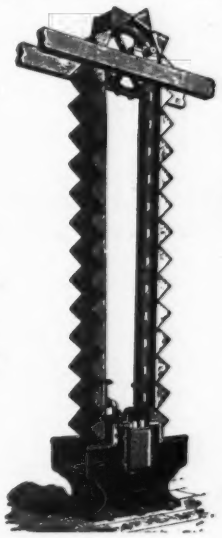

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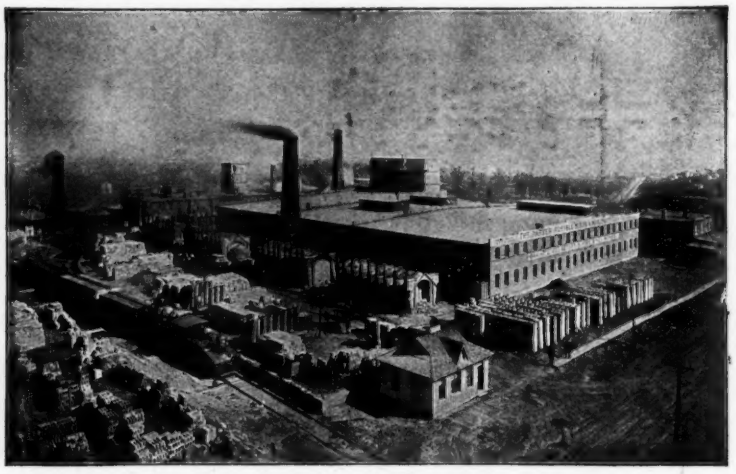

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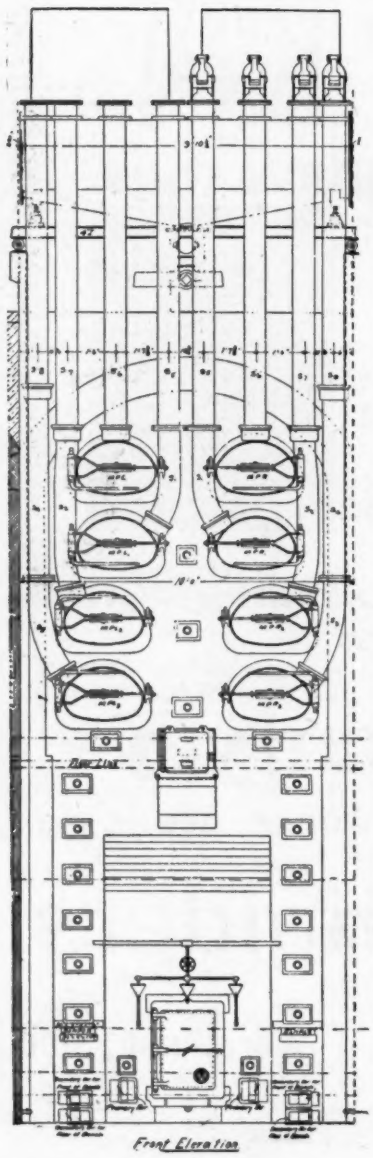

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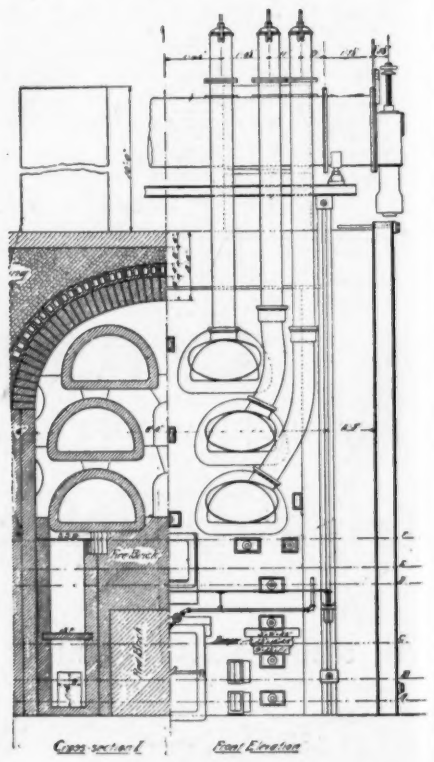

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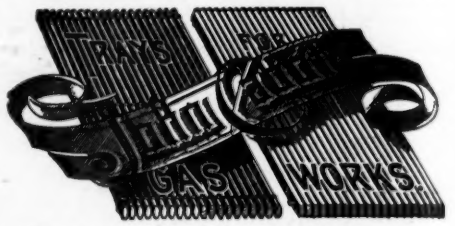

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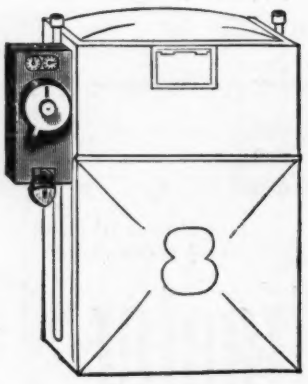

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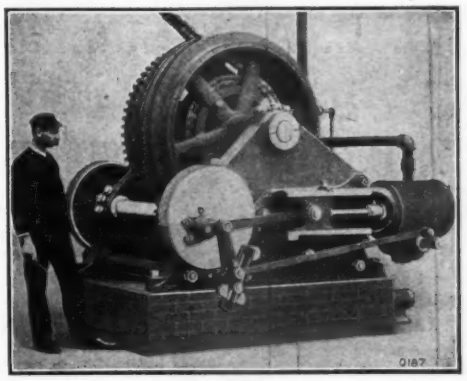

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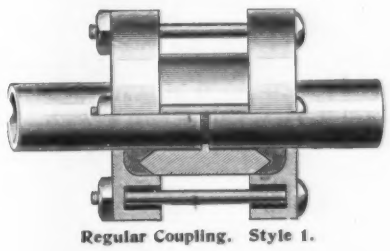
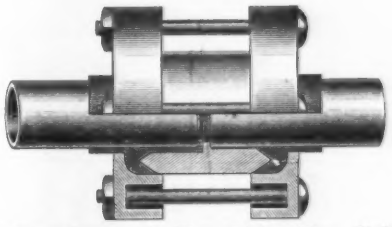
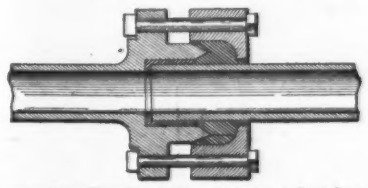


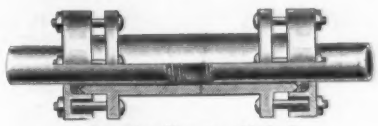
Regular Coupling. Style 1.



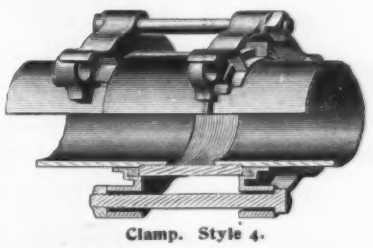
Insulating Coupling for Wrought Iron Pipe. Style 5



Insulating Coupling for Bell and Spigot Cast Iron Pipe Style 6.



Regular Sleeve. Style 2.



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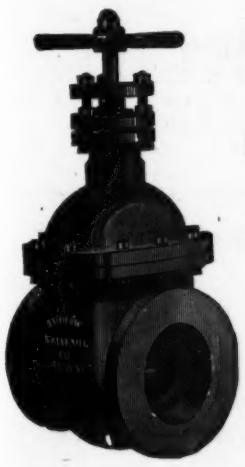

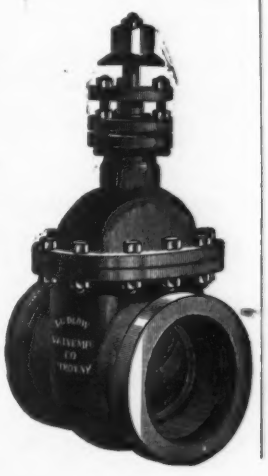

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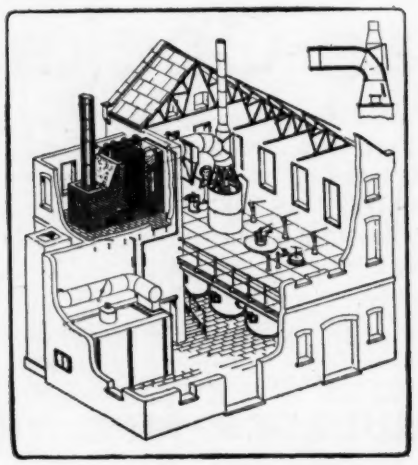

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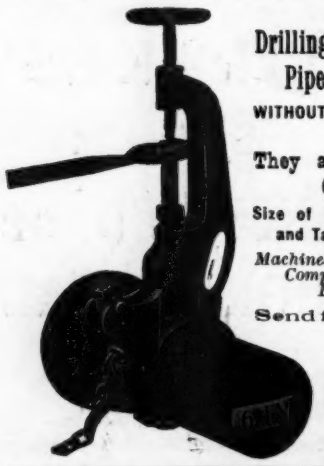

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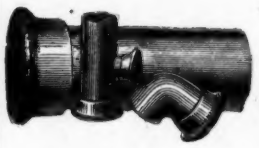

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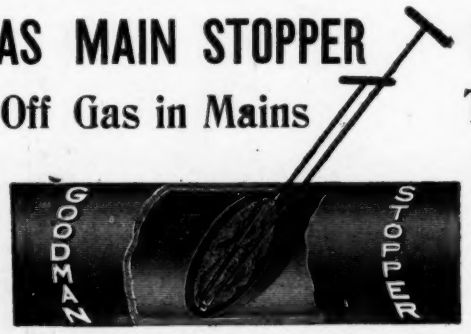

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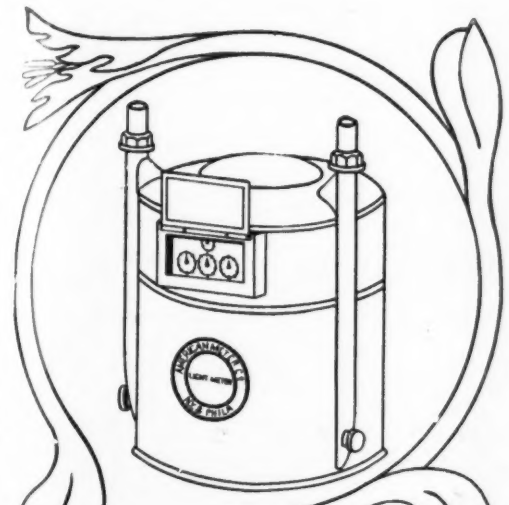
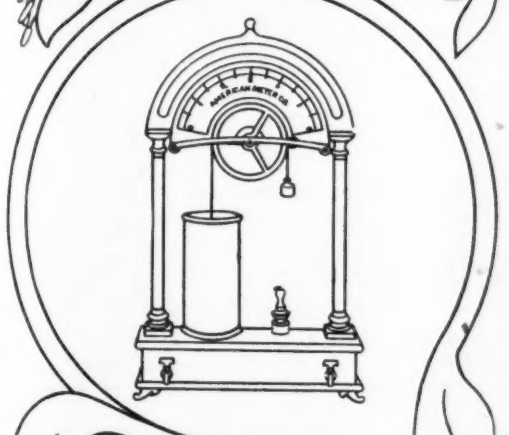
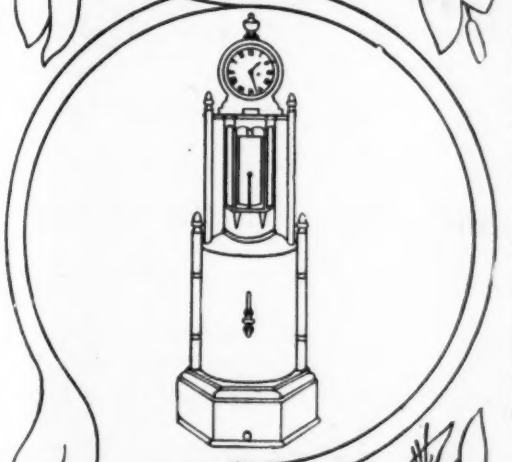
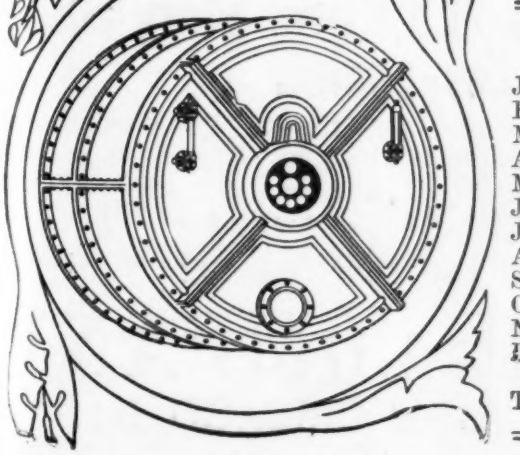








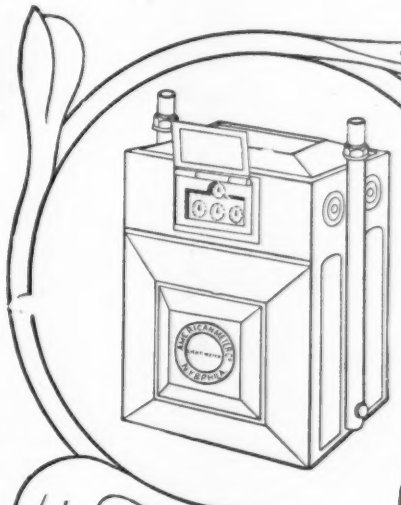
PUBLIC LIGHTING TABLE.

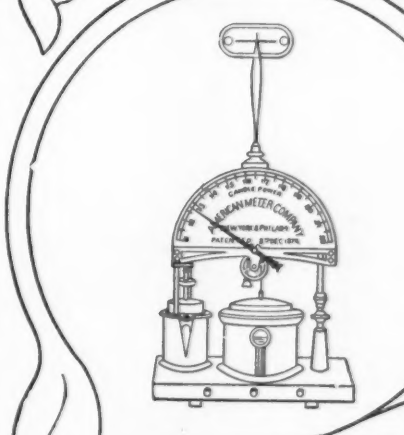
JUNE, 1903.

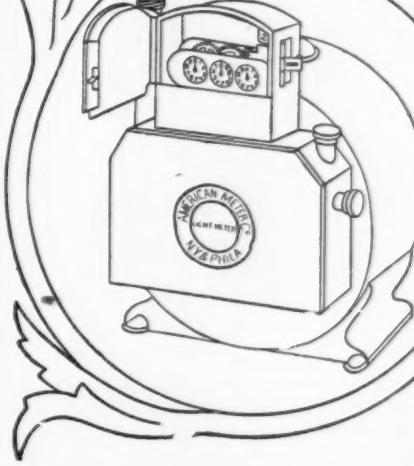
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Extingnish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Mon.	1	11.10 PM	3.30 AM	7.15	3.15
Tue.	2	11.40 FQ	3.30	7.15	3.15
Wed.	3	12.20 AM	3.30	7.15	3.15
Thu.	4	12.50	3.30	7.25	3.15
Fri.	5	1.30	3.30	7.25	3.15
Sat.	6	2.00	3.30	7.25	3.15
Sun.	7	2.40	3.30	7.25	3.15
Mon.	8	No L.	No L.	7.25	3.15
Tue.	9	No L. FM	No L.	7.25	3.15
Wed.	10	No L.	No L.	7.25	3.15
Thu.	11	8.00 PM	9.30 PM	7.25	3.15
Fri.	12	8.00	10.20	7.25	3.15
Sat.	13	8.00	10.50	7.25	3.15
Sun.	14	8.00	11.30	7.25	3.15
Mon.	15	8.00	12.00	7.25	3.15
Tue.	16	8.00	12.30 AM	7.25	3.15
Wed.	17	8.00 LQ	1.00	7.25	3.15
Thu.	18	8.00	1.30	7.30	3.15
Fri.	19	8.00	2.00	7.30	3.15
Sat.	20	8.00	2.40	7.30	3.15
Sun.	21	8.00	3.30	7.30	3.15
Mon.	22	8.00	3.30	7.30	3.15
Tue.	23	8.00	3.30	7.30	3.15
Wed.	24	8.00 NM	3.30	7.30	3.15
Thu.	25	8.00	3.30	7.30	3.15
Fri.	26	8.00	3.30	7.30	3.15
Sat.	27	8.00	3.30	7.30	3.15
Sun.	28	8.00	3.30	7.30	3.15
Mon.	29	9.50	3.30	7.30	3.15
Tue.	30	10.20	3.30	7.30	3.15

TOTAL HOURS LIGHTING DURING 1903.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	245.00	January	423.20
February	192.00	February	355.25
March	201.00	March	355.35
April	167.20	April	298.50
May	152.00	May	264.50
June	131.00	June	234.25
July	140.40	July	243.45
August	156.20	August	280.25
September	171.20	September	321.15
October	198.20	October	374.30
November	216.30	November	401.40
December	232.10	December	433.45
Total, yr.	2203.40	Total, yr.	3987.45







NEW YORK, 33 Nassau Street. PHILADELPHIA, Broad and Arch Streets. CHICAGO, Foot of Orleans Street. BOSTON, 624 Tremont Building.
CLEVELAND, 809 Cuyahoga Building. ST. LOUIS, 712 Roe Building. SAN FRANCISCO, 712 Polk Street.

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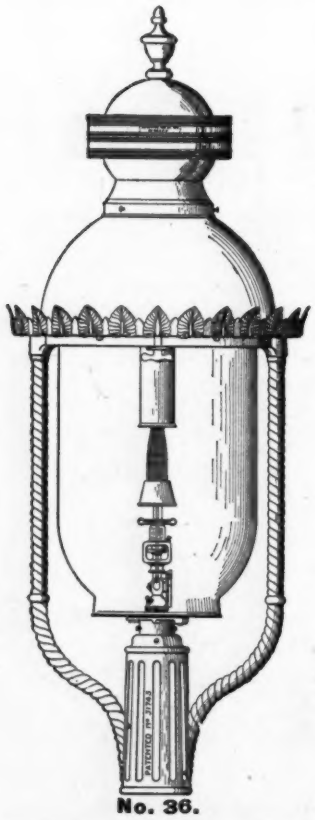

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IT LIGHTS THE STREET.

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3. The greatest amount of candle power with least consumption of gas.
4. A by-pass cock so constructed as to permit all or only one mantle burning at a time.
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May we Send you ONE Lamp?

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Blue Island, Ills.	Jersey City, N. J.	Oneonta, N. Y.
Boonton, N. J.	Laconia, N. H.	Plainfield, N. J.
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Champaign, Ills.	Martinsville, Ind.	Scranton, Pa.
Coney Island, N. Y.	Memphis, Tenn.	South Brooklyn, N. Y.
Dallas, Tex.	Newark, N. J.	Suffern, N. Y.
Danville, Ills.	New Brunswick, N. J.	Swedesboro, N. J.
Des Moines, Ia.	New London, Conn.	Syracuse, N. Y.
Evanston, Ills.	New Orleans, La.	Washington, N. C.
Evansville, Ind.	Norfolk, Va.	Woonsocket, R. I.

TOTAL SETS, 1902, ... 51
TOTAL DAILY CAPACITY, 1902, . . 32,825,000 cubic feet.
TOTAL SETS TO DATE, ... 447
TOTAL DAILY CAPACITY, ... 299,670,000 cubic feet.

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Established 1858. Incorporated 1890.
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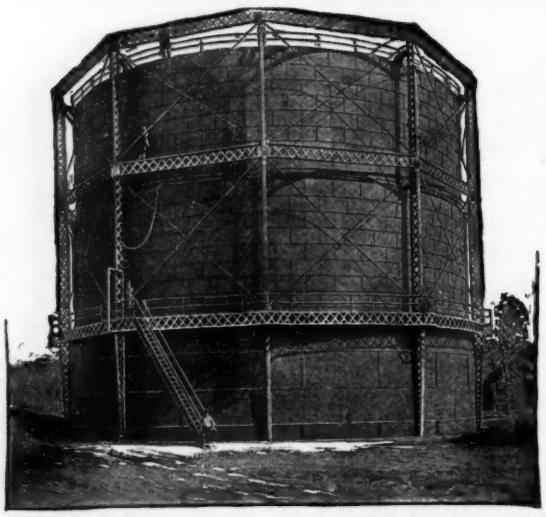

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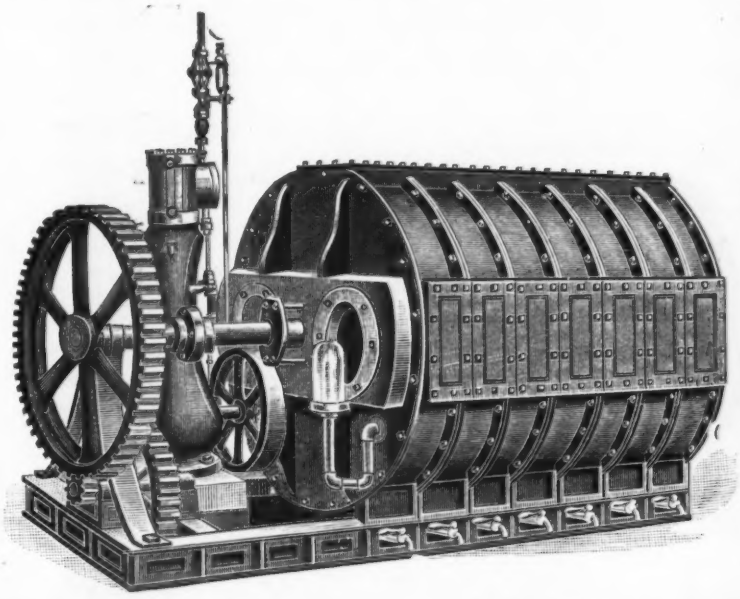

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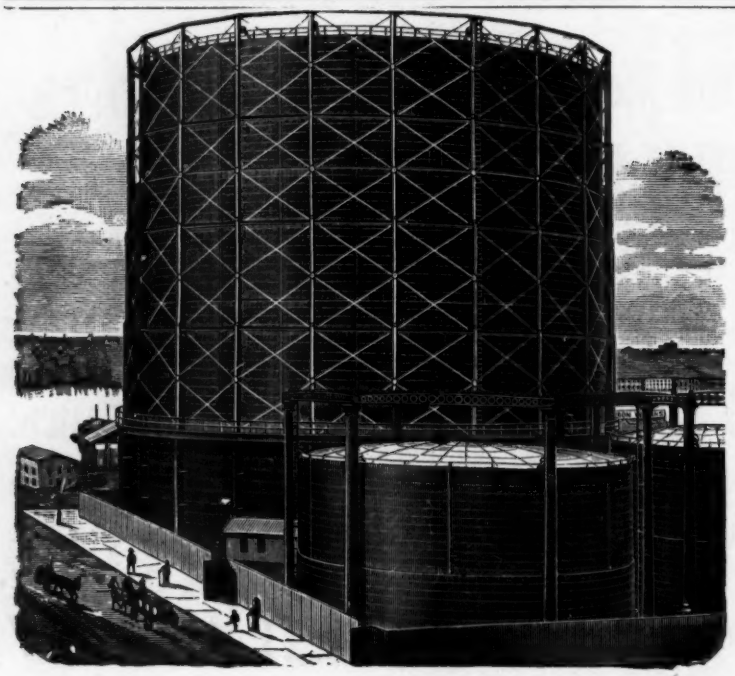

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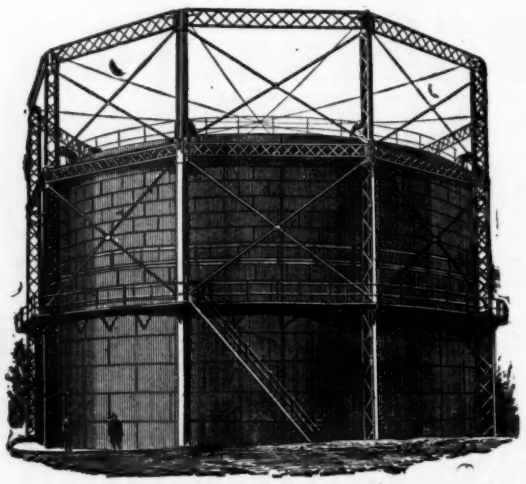

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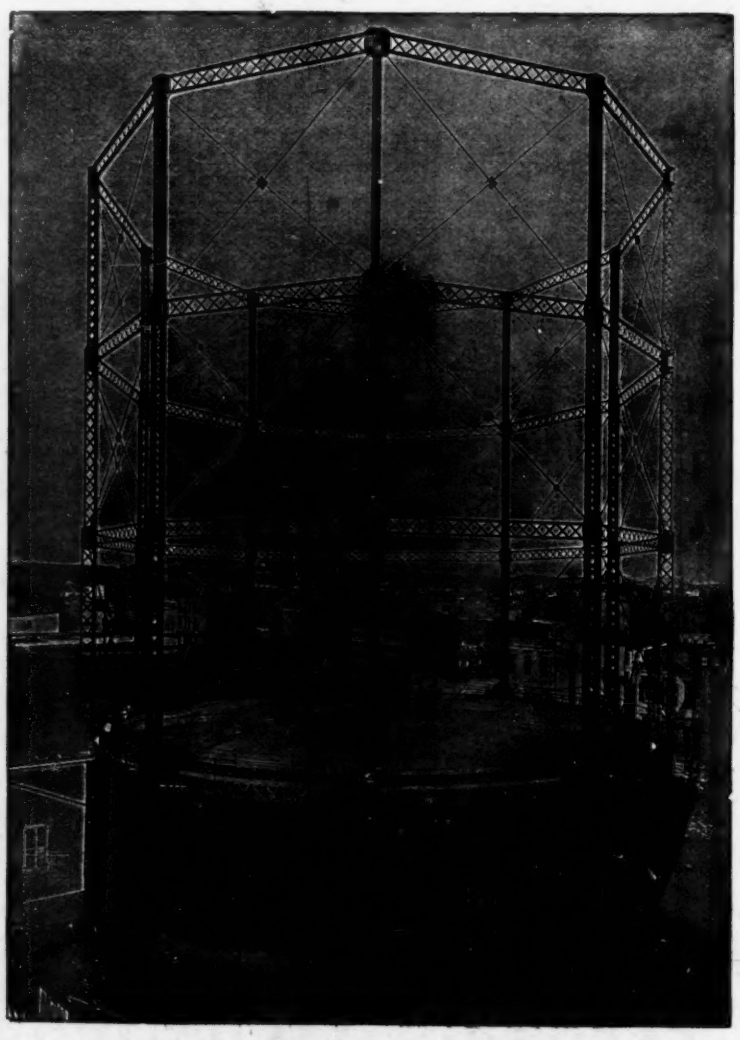

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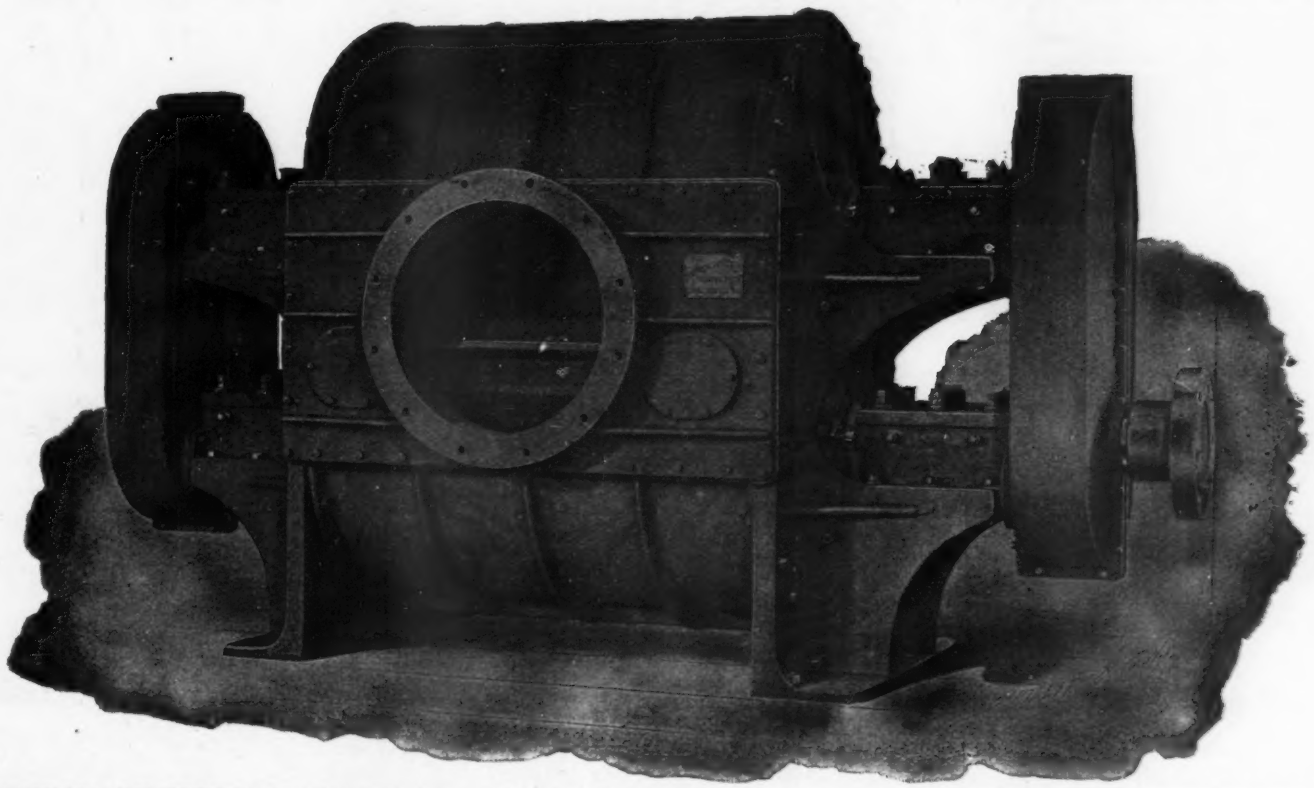

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